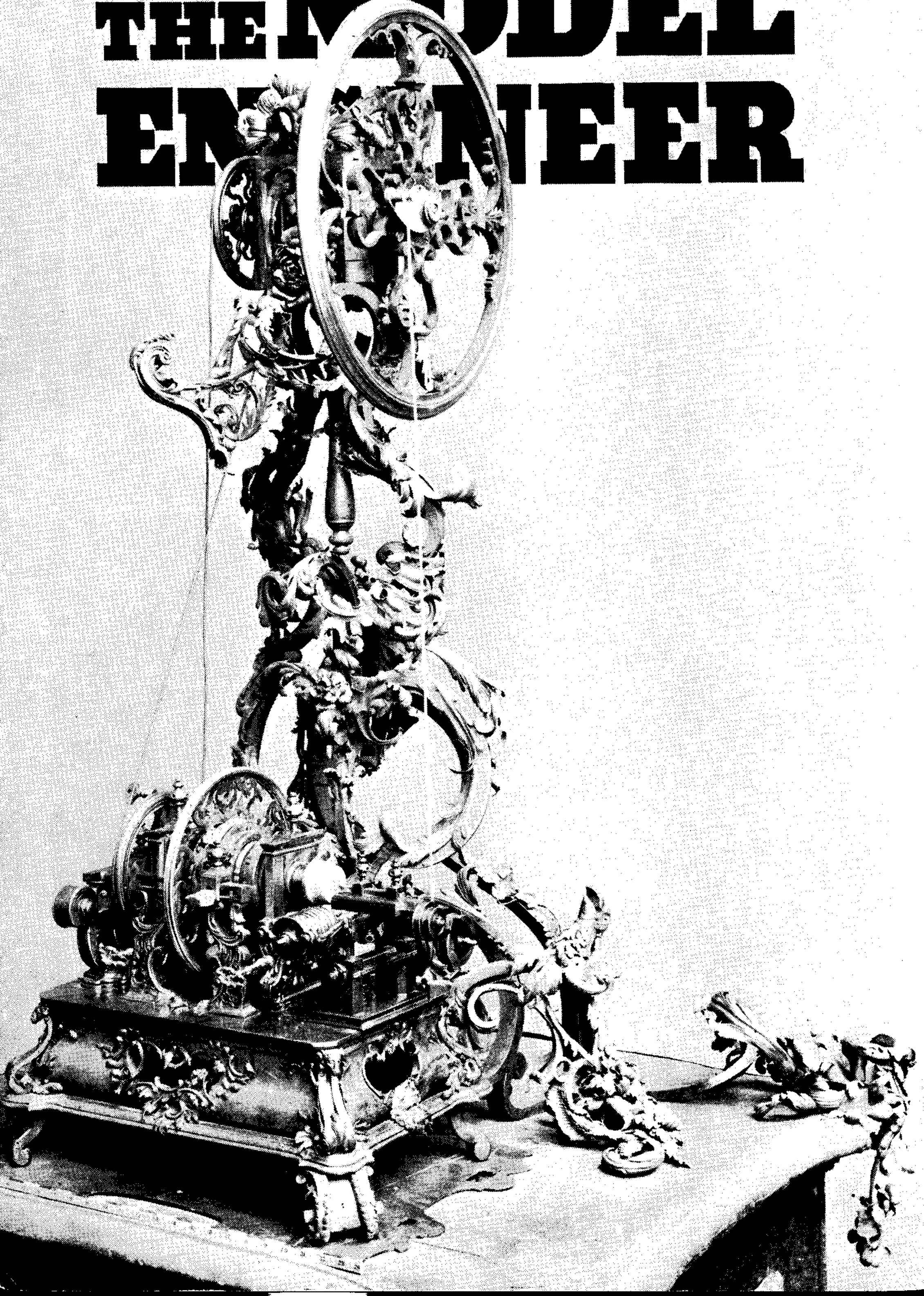
Vol. 106 No. 2665 THURSDAY JUNE 19 1952 9d.

THE MODEL ENGINEER



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

19TH JUNE 1952 VOL. 106 NO. 2665

SMOKE RINGS

Our Cover Picture

● THIS WEEK we show a German lathe made about 1750 for ornamental turning. It was driven from a pulley on an overhead shaft carrying a flywheel, which received its motion from a cord connected to a treadle in the base. This shaft was supported in an adjustable bearing box, carried by a framework secured to a wooden cabinet with which the lathe was combined. The whole machine was covered by a mass of rococo decoration, by which the framework was concealed.

The mandrel headstock was hinged at its base, and provided with a strong spring to keep any one of the several cams or rosettes, which the mandrel carried, in close contact with a fixed rubber. A rocking or chattering motion was thus imparted to the mandrel as it revolved. On a simple saddle was located a stationary cutting tool.

A pattern, such as was employed for the backs of watch cases, was produced by using a cam with 24 similar waves: by means of a tangent-screw the cam was rotated relative to the work, through half a wave by the consequent cuts, and this caused the depression of one length on the work to correspond with the tops of the waves of its adjacent wing, and produced the appearance of spiral curves, although the design was built up entirely of concentric rings. As different cams were provided, many designs could be obtained by suitably manipulating the tangent-screw.

Another set of cams was arranged to give end motions, so that any cylindrical surface could be ornamented, or lines cut to varying depths on fashioned work.

The Rose engine is still used for certain decorations, but in the modern machine the cam is relatively very much larger than in the early example.

Crown Copyright, from an exhibit in the Science Museum, London.

The Wicksteed Regatta

● FOR MANY years now, the annual model power boat regatta held at Wicksteed Park, Kettering, has been one of the most popular events of the season. Its location is favourable for access by road or rail from all parts of the Midlands, Home Counties, and London, and apart from the attractions of the boating pond, other diversions are available in the park which solve the enthusiast's embarrassing problem of "what to do with the family" while he indulges in his favourite pastime. The catering facilities are also excellent, and capable of dealing with a large influx of visitors. Club parties are, however, advised to give not less than a week's notice of lunch and tea requirements to ensure service and avoid delays. Since the war, the membership of the Wicksteed Model Yacht and Power Boat Club has not been very strong, but their enthusiasm has not abated, and they have never failed to stage a good day's sport, thanks largely to the efforts of the Ward family, on whom most of the work of organising the event has devolved. This year's regatta will be held on Sunday, July 6th, commencing at 11.30 a.m., and will comprise races for "A," "B" and "C" classes, and a steering competition for prototype boats. All enquiries regarding this event should be made of the Hon. Secretary, Mr. D. Ward, 5, Noble Avenue, Irthlingborough, Northants.

News from Northallerton

● WE HAVE received a very newsy letter from Mr. A. Dixon, hon. secretary of the Northallerton and District Model Engineering Society, who reports that considerable activity is in progress. Another exhibition has been planned and will be held from September 1st to 6th next; meanwhile, a programme of interesting visits is being arranged for the summer season.

The society's track superintendent, Mr. L. Simms, in association with Messrs. H. Logsdail, H. Bright, G. Duffield and J. Taylor, is at work on the construction of a 0-6-0 pannier-tank locomotive for 5-in. gauge; this is one of the well-known "Speedy" design by "L.B.S.C.," and we learn that when it is finished it is to be presented to the society.

At the moment of writing, other members have under construction: a *Royal Scot* and a free-lance 4-4-2 engine for 3½-in. gauge; an "M.E." cine projector; a free-lance milling machine having a range of speeds from 36 to 360 r.p.m., and an "M.E. Allchin" traction engine. In the aircraft section, many new planes are being built. All this adds up to quite a considerable amount and indicates plenty of enthusiasm; since the society already possesses a locomotive running track and a miniature car track, we do not doubt that it looks forward to the coming season with great confidence.

Mr. Dixon ends his letter by sending to all fellow model engineers good wishes for many happy hours and every success. If anybody wants any information about the society and its activities, he will be glad to supply it; his address is 10, Hartington Terrace, Northallerton.

Television and Hobbies

● EVERY IMPORTANT invention brings in its wake a more or less radical change in human habits and customs, the impact of which is often unconsidered until it becomes an accomplished fact. The steam engine, the locomotive, the internal combustion engine, have all had a profound influence on the life of the community, and in more modern times, radio and television have been and are being responsible for still more changes. A good deal of concern is felt at present as to the effect television is having on the spare-time occupations of its devotees, and particularly in respect of hobbies.

It may be said that to those who regard hobbies merely as an escape from boredom, television offers a pleasant and effortless substitute, acting like a narcotic drug on initiative and creative activity. There is, however, another side to the picture, as many of the television programmes have featured subjects which are of great interest to all who follow art and craftsmanship, and have given them visions of new worlds to conquer. In other cases, the visual presentation of methods and processes involved in either professional or amateur crafts have stimulated interest in those hitherto uninitiated, and given them an urge to try to do things for themselves. Let us hope that this will be the predominant tendency, for whatever happens, television is here to stay, and we can no more stem its influence than we can control the tides. Like all other aspects of progress, it is capable of being used either for good or ill, and it is up to the human race to see that it becomes the master of science and not its slave.

Locomotive and General Railway Photographs

● WE HAVE received a copy of list No. 129 from Locomotive & General Railway Photographs, and we note that this business, formerly at Padstow, Cornwall, has been transferred to 9, Regent Place, Rugby, Warwickshire, to which all future communications should be sent.

List No. 129 contains particulars of a large number of photographs of locomotives, coaches, stations, signals, etc., which should appeal to collectors and model makers. Some of the railways included in this list are uncommon, such as Penrhyn, Padarn, Snowdon, Bicslade Tramway, Stratford & Midland Junction and the like, as well as several subjects dating from the pre-nationalisation era of British Railways.

We note that list No. 118/1, covering 89 road locomotive subjects, is still available, price 3d., and should be of interest to a large number of our readers who may not yet have seen it.

A Request from Australia

● WE HAVE received from Van Houtan's Studio of London, 276, Flinders Street, Melbourne, Victoria, Australia, a letter announcing an "All-Electric Homes" Exhibition to be held in March, 1953, in the Exhibition Buildings, Exhibition Street, Melbourne.

Van Houtans are endeavouring to have sent out from England some models of interest to the people of Melbourne, and would be pleased to hear from any of our readers who would be willing to sell, or loan, any outstanding models for the occasion. Interested readers are invited to write to Mr. Jules van Houtan at the Studio address given above.

A New Thought

● MR. W. M. GOODRICH, of Overland Park, Kansas, U.S.A., in the course of a letter recently received, states that he is a "Live Steam" enthusiast who has built a number of engines. All, except one built, or rather finished, in 1917, have been made to "the world standard 'words and music' of 'L.B.S.C.'" Of that worthy, Mr. Goodrich writes :—

"He hasn't let me down yet. In addition to his sound ideas, he is a super salesman. Do you think he would take offence at that appellation? Every article he writes inspires or impels you to make something, and that, on the whole, means the purchase of material or tools—more power to him."

This is yet another example of a type of letter of which many have come, in past years, from readers in distant lands. Most have expressed pleasure, and sometimes surprise, at the fact that engines built to the well-known "words and music" always give absolute satisfaction immediately they are put in steam; but we do not think that anyone has previously suggested that "L.B.S.C." is a salesman! The fact, however, now seems to be obvious, and we do not think he is likely to be offended by it.

*The Crofton Beam Engines

by Ian Bradley

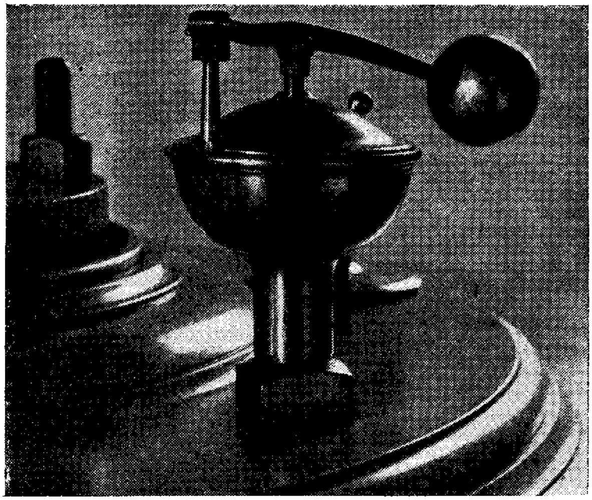
(Photographs by H. H. Dennis, Newbury)

THE cylinder of the No. 2 engine is in one piece and has a bore of 38 in. and a stroke of 8 ft.

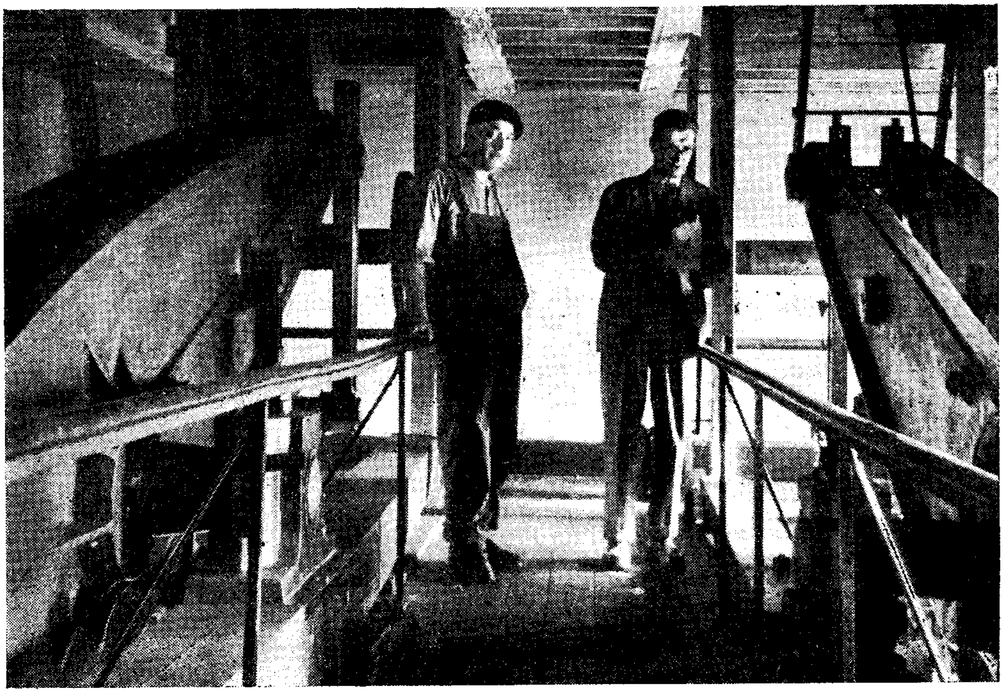
The beam has a length of 25 ft. 6 in., the same as the No. 1 engine, but its depth is only 36 in. This difference in measurement will readily be seen in the illustration depicting the top floor of the engine house.

The disposition of the parallel motion is somewhat different from that of the No. 1 engine. Whereas in the No. 1 engine the fulcrum of the motion is set on the centre-line of both engines and pump piston-rods, the fulcrum of the No. 2 engine is set some 16 in. outward from this point. I am advised by the experts that this is the sign that enables a Watt and a Cornish-type beam engine to be distinguished from each other.

*Continued from page 769, "M.E.," June 12, 1952.



Cylinder lubricator, James Watt engine



Among the beams. James Watt engine on the left

As is the case with the No. 1 engine, No. 2 has a wealth of beautifully made parts. A very striking example is the adjustable gib-key for the link motion illustrated in Fig. 4. There are plenty of these keys to be found on the engine and I am told that, from the engineer's point of view, they are a very practical device, because there is no chance of the keys slacking back.

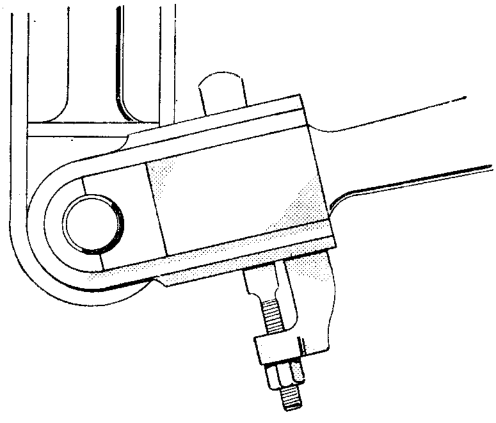


Fig. 4. An adjustable gib key fitted to the No. 2 engine

Some while ago, a series of tests was carried out to determine the efficiency of the plant as a whole. The results of these tests are embodied in the accompanying table, and I am indebted to Dr. Calvert, of Liverpool University, who carried out the tests, and also to the Newcomen Society, for permission to quote them.

The Engines at Crofton Top

	Engine No. 1	Engine No. 2
Speed, strokes/min. ..	11.5	10.2
Water, gals./min. ..	2,430	2,280
Steam, cut-off ..	0.16 stroke	0.10 stroke
Mean effective pressure	13.2 p.s.i.	12.75 p.s.i.
Indicated h.p. ..	37.6	42.0
Water h.p.	29.4	27.6
Indicated thermal efficiency. Steam cyl. ..	Not determined	6·1%
Overall Thermal Efficiency of plant ..	Not determined	2·5%

It will be seen that no final figures were obtained for No. 1 engine, but it is safe to assume that the efficiency could not have been much greater than that of the No. 2 engine. However poor these efficiencies appear in cold print, there is surely another side to the picture, and that is the cost of maintaining the engines and pumps. When set against the useful work done, this cost is very small indeed.

Were the whole plant to be scrapped and replaced by a modern diesel or electrically-driven pumping plant, I would suggest that, long before one hundred and fifty years had elapsed, the complete installation would have undergone several major overhauls. Moreover, the motive power and pumps would have been completely replaced several times by then. The engines at Crofton are the complete vindication of slow-moving low-pressure steam machinery. Those who have seen this type of engine running cannot fail to admire the easy manner in which they do their work; and I had almost added "silently" for, apart from the click of the valve mechanism and, in the case of No. 1 engine, the dull thud of the pump foot-valve closing, there is little to be heard but the crashing discharge of water—a ton at each stroke—as the pumps empty themselves into the canal feeder.

The Pumps

No. 1 engine drives a simple bucket-pump capable of delivering approximately 2,500 gal. per minute at 11½ strokes per min. There is an intake valve at the base of the pump cylinder and a delivery valve in the piston itself. A spare delivery valve body is kept on the premises, and a truly gigantic affair it is. The water is delivered by way of the cylinder barrel and spills into the canal feeder through an open spout, much in the same way as a village pump. The discharge of water may be seen from inside the engine house through an inspection hole in the wooden covering around the pump piston-rod. At one time, in addition to the main pump, ram

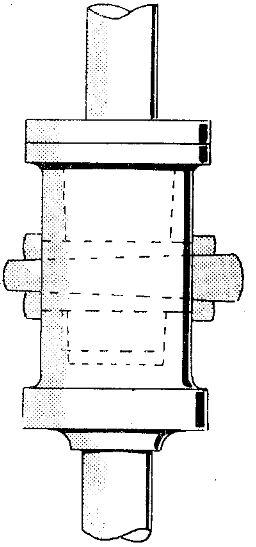


Fig. 5. Coupling for the main pump-rod, No. 1 engine

pumps were attached to the beams for the purpose of supplying Tottenham House, Savernake, with water. It was on the understanding that this would be done that the owner of the land, the then Marquis of Aylesbury, sold the site so that the waterworks could be built.

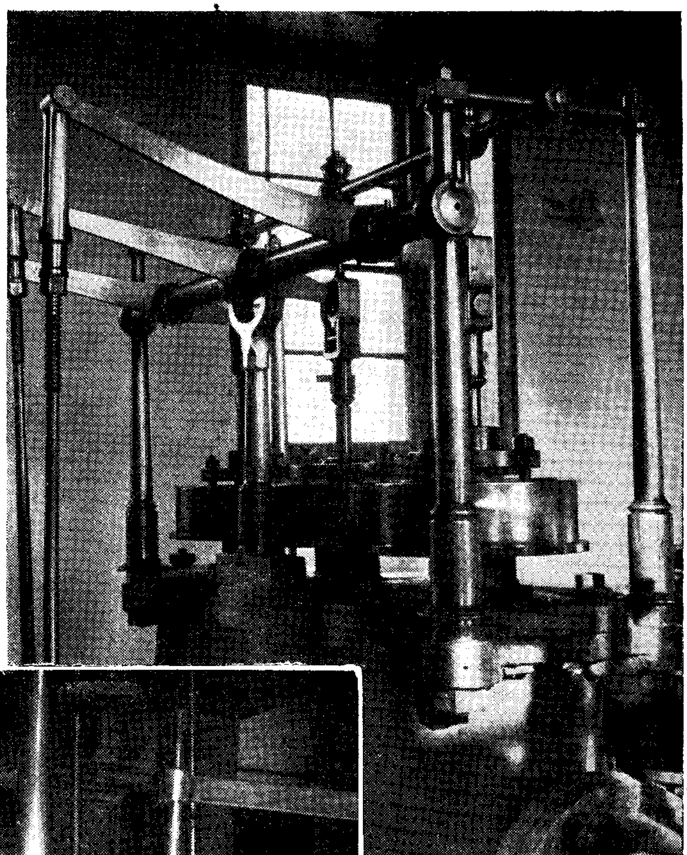
One pump only now remains, that once connected to No. 1 engine, the other having been removed when some repairs to the transverse wall were being carried out.

The present engineer-in-charge, Mr. F. Wilmott, has carefully cleaned and repainted this pump so that it is now in exhibition condition, as indeed is everything about the whole installation. Mr. Wilmott kindly allowed me to descend to the top of the hotwell to inspect the house pump. Many years ago, when the necessity for supplying Tottenham House had ceased, the pumps were used for supplying water to the engineer's cottage, and much of the large diameter piping was discarded.

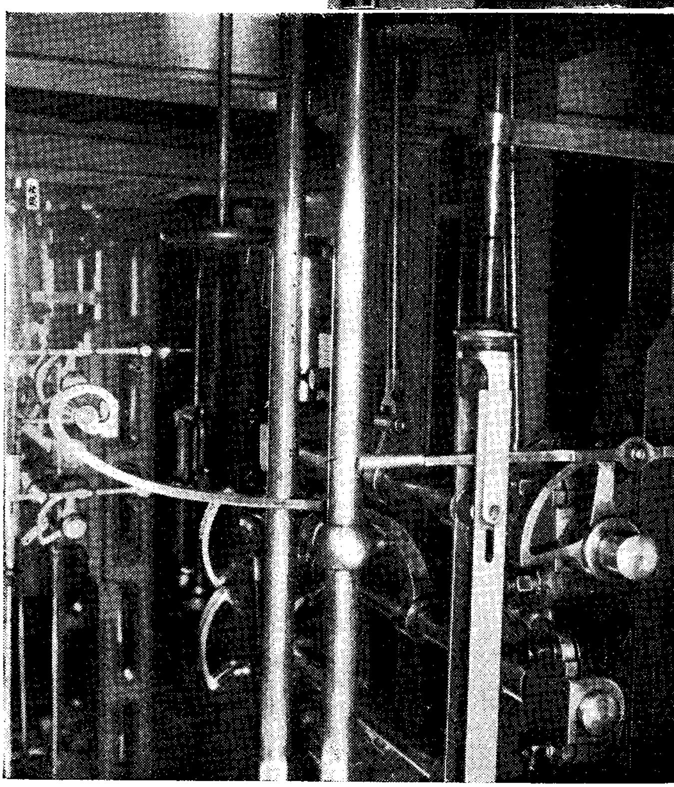
Improvements

In passing, I think it should be mentioned that Mr. Wilmott has done much to improve the conditions in the well. A window has been put in at the top of the well chamber, and all pipe work, castings and metal work not actually under water have been painted. In addition, the brickwork is being colour-washed. One might possibly expect these conditions existing in a non-working museum-piece, but to find them in connection with engines working eight hours a day at least four days a week is something that students of engineering matters should be thankful for.

(To be continued)



Upper valve-gear of the James Watt engine



Controls and valve mechanisms: In the foreground, for No. 2 engine. Behind, for the James Watt engine

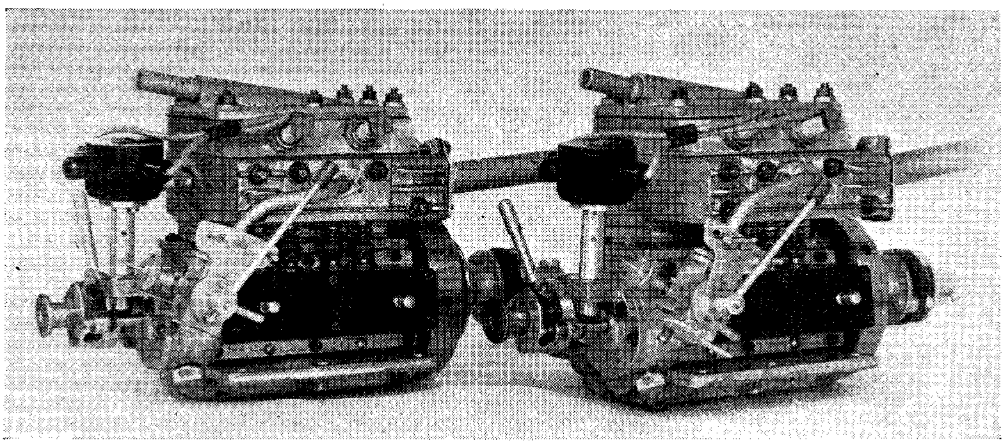
TWO MODEL MARINE ENGINES

by Geo. A. Nurthen

(*Photographs by R. Hobbs*)

THESE two engines are identical in construction, the only main difference being in the direction of rotation of each.

They are of 24 c.c. twin-cylinder water-cooled side-valve type, the dimensions being as follows: Bore 1 in., stroke 29/32 in., overall height $5\frac{1}{2}$ in. (from bearers 5 in.), length overall $9\frac{1}{2}$ in. (without coupling $7\frac{1}{4}$ in.), weight $6\frac{3}{4}$ lb.



The castings, which comprise the following: cylinder-head cover, cylinder-head, cylinder block, crankcase, camshaft tunnel, induction manifold, timing case, timing case cover, inspection cover and dipstick, and sump, were made in aluminium alloy from my own patterns, and the connecting-rods and pistons in D.T.D. 424 alloy. The cylinder block has two Meehanite liners and four phosphor-bronze valve liners inserted.

The water jackets were machined in the block and the Meehanite liners lightly coated with shellac varnish before insertion, as a protection against rust.

Each piston carries two $\frac{1}{16}$ in. wide compression rings.

Valves

These were made from 100-ton steel, and as the drawing shows, are of robust construction. The inlet and exhaust ports of 9/32 in. dia. are as large as possible to obtain efficiency.

Tappets

These are of $\frac{1}{4}$ in. dia. silver-steel, hardened and tempered light straw, and hollowed out to give lightness. The tappet liners are of Meehanite and the tappets are a lapped fit and work directly on to the valve spring lock-nuts, which are case-hardened.

Camshaft

This is of fabricated construction, the cams being separately fixed to the shaft.

The shaft, which is $\frac{5}{16}$ in. dia. and of silver-steel, runs in two phosphor-bronze bearings, each having a bearing length of $\frac{5}{8}$ in. The cams are of mild-steel, case-hardened, and are a tight fit on the shaft, and each pinned in position by a 5/64 in. taper pin. The method adopted for making the shaft is as follows:—

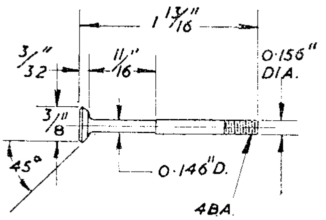
Cams

First two actual-size master cams were made for inlet and exhaust, from silver-steel, and hardened. An engine was assembled completely and a 360 deg. protractor clamped to the flywheel with a pointer screwed to the cylinder block. The engine was turned to t.d.c. and the pointer set at 0 deg. The master cams, as yet unhardened, were put on the camshaft and each locked with a 4-B.A. Allen grub-screw, directly under each respective valve. Only one set of valves was necessary to test the setting. The engine was then turned slowly in the direction in which it was intended to rotate and the profile of the "roughed-out" cam plotted on the protractor. i.e., the inlet valve cam was required to commence its lift at 10 deg. B.T.D.C. and reach its maximum lift at 110 deg. protractor reading and close at 230 deg. (50 deg. A.B.D.C.).

The master cam was carefully filed until the profile was correct.

The same procedure was adopted with the

exhaust valve which was required to commence its lift at 60 deg. (120 deg. protractor reading) B.B.D.C. and reach its maximum lift at 250 deg. and close at 20 deg. A.T.D.C.



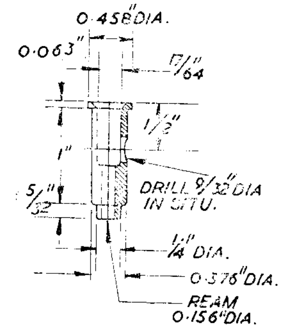
Valve details (100-*ton steel*)

When the profiles were correct, the cams were removed, polished and hardened.

These were now used as templates to which the engine cams were filed very carefully. These were then assembled on each engine, and checked by protractor, as with the master cams, and finally finish-filed and polished. After marking the timing gears, the complete camshaft was removed from the engine and the cams were drilled and reamed *in situ* for the taper pins.

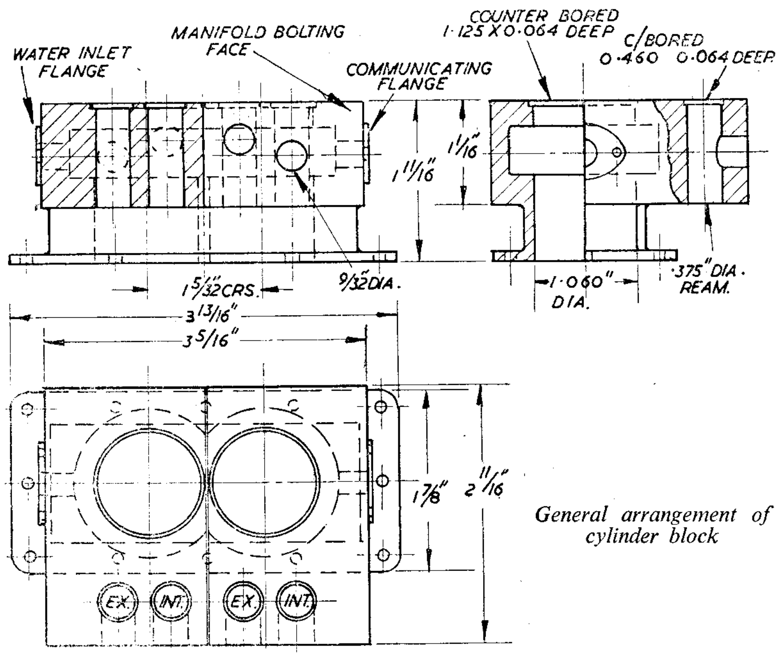
Finally, the cams were removed once more and case-hardened to a depth of 0.005 in. *polished* and replaced on the shaft and pinned through the previously drilled holes. Final checking was again necessary to ascertain that each cam was correctly located. This was in each case found to be perfectly correct.

This method of construction appears to be a lengthy one, but has certain advantages, however,

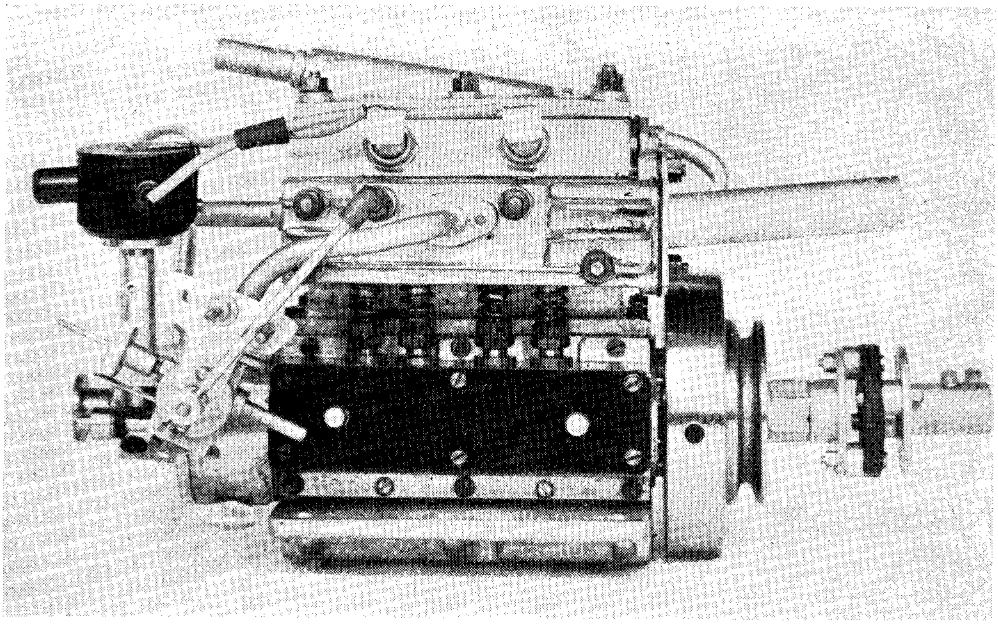


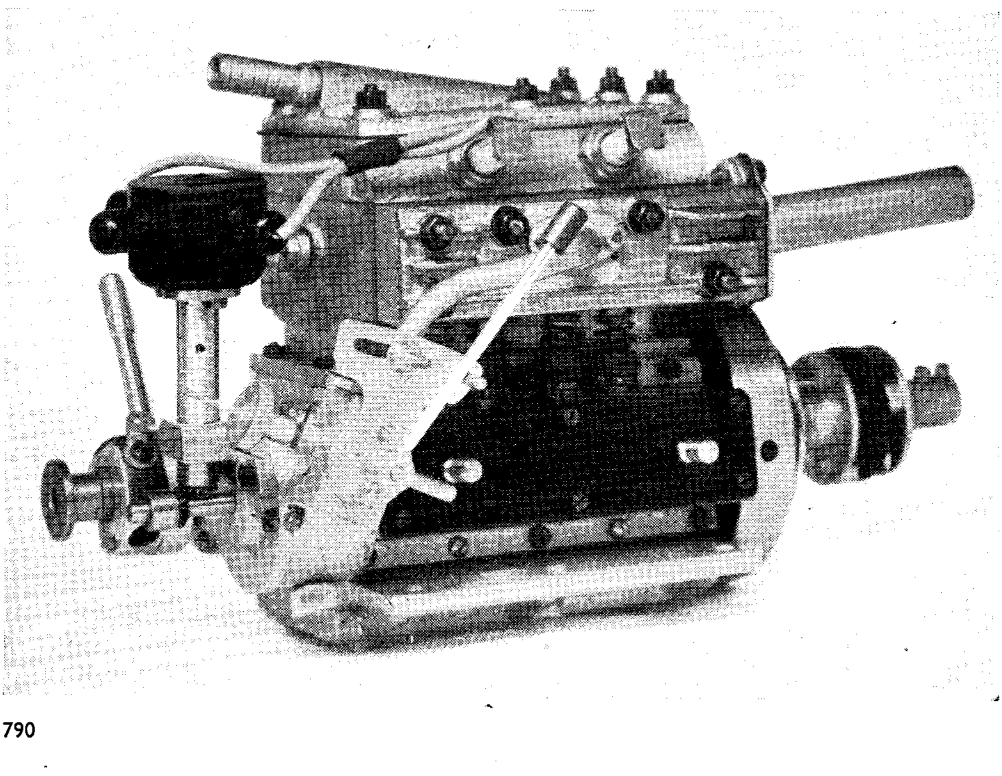
Valve liner

and at least ensures trouble-free hardening without distortion or cracking, as might occur with a camshaft made from the solid. Another advantage is that any individual cam can be removed, should wear occur. I have carried out exhaustive tests with these and other engines of the same design, but of larger and small capacity, and the camshafts have proved entirely satisfactory regarding hardening and especially location. The valve lift is 5/64 in., tappet clearance 0.005 in. Engine timing: inlet opens 10 deg. B.T.D.C., closes 50 deg. A.B.D.C.



General arrangement of cylinder block

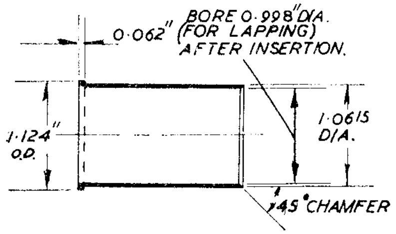




Exhaust opens 60 deg. B.B.D.C., closes 20 deg. A.T.D.C.

Crankshaft

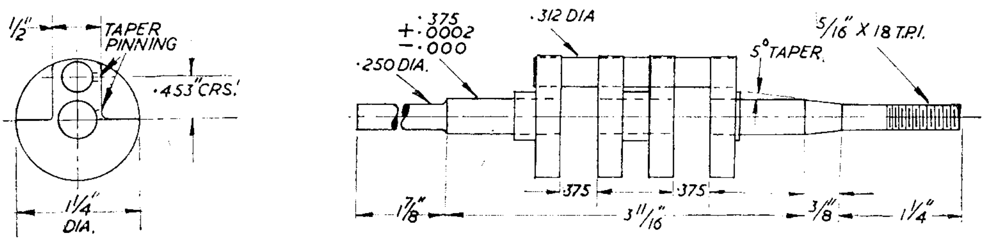
This is also of built-up construction, and runs in two ball-races, one in each crankcase end cover, the rear cover also carrying a phosphor-bronze bearing of $\frac{1}{2}$ in. length. Back covers are of duralumin.



Cylinder liner

The crankshaft is made in seven pieces. The webs were made from mild-steel and faced off perfectly parallel to 0.250 in. thick, and each set of four were clamped together on a faceplate jig, located through the $\frac{3}{8}$ in. centre bore, and the crankpin hole bored. They were then shaped, and fitted in the correct position on the shaft, to which they were a light push fit, and pinned *in situ* with 3/32 in. taper pins. The silver-soldering was carried out with an oxy-acetylene torch. I anticipated deflection of the shaft when, after silver-soldering, it was cut away between the webs but this did not happen. This, I think was due to the care taken in machining the shaft and webs to close limits, ensuring perfect alignment before soldering, and especially the use of the welding torch which heated the crankshaft only where it was necessary.

The main shaft is turned from $\frac{7}{16}$ in. dia. silver-steel, and crankpins from $\frac{5}{16}$ in. dia. silver-steel.



Details of crankshaft

Lubrication

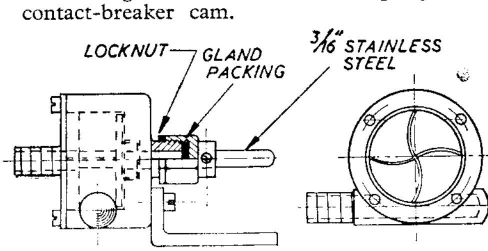
The engines are splash lubricated. The sump is fitted with an oil trough suitably drilled, into which the connecting-rods dip. The oil is splashed to the big-ends, main bearings, cylinder walls and camshaft. The sump is fitted with a drain cock and the crankcase fitted with an inspection cover incorporating a dipstick and breather. The timing case is one-third filled with oil, thus lubricating the timing gears.

Carburettor

This is constructed in brass and basically follows the carburettor designed by Mr. E. T. Westbury for the "Seal" engine described in THE MODEL ENGINEER. It is of the barrel throttle type, suction operated. The main jet size is 0.030 in. dia. and the choke bore at the discharge end 17/64 in. dia. It is very efficient and gives a good range of control over the engine speed. It was not considered necessary to use a float chamber, which would be an added complication. The fuel level in the tank is, when filled, approximately $\frac{1}{4}$ in. below the jet level, and no appreciable difference in engine performance is noted when the level alters. The quadrant, which carries two adjustable stops, and the long throttle lever, are fitted only for radio-control operation, and the lever to facilitate easy hand manipulation of the throttle when the engine is used for boat propulsion.

Ignition

H.T. is supplied from a single coil through a distributor driven at half engine speed through 1 : 1 mitre bevel gears on the camshaft. The contact-breaker is driven at engine speed. Provision is made for fitting a magneto to each engine, the drive being taken from the half-coupling on the contact-breaker cam.



Water circulating pump—half size (brass)

Water Circulating Pump

This is a separate unit and is designed to be driven from the propeller shaft of the launch in which the engine is installed through 1 : 1 bevel gearing. Drive for the pump can, of course, be easily arranged for stationary running.

Each engine has its own pump, and these simple impeller type pumps have proved reliable and very satisfactory.

A $2\frac{1}{4}$-in. FABRICATED CENTRE LATHE

by G. D. Reynolds

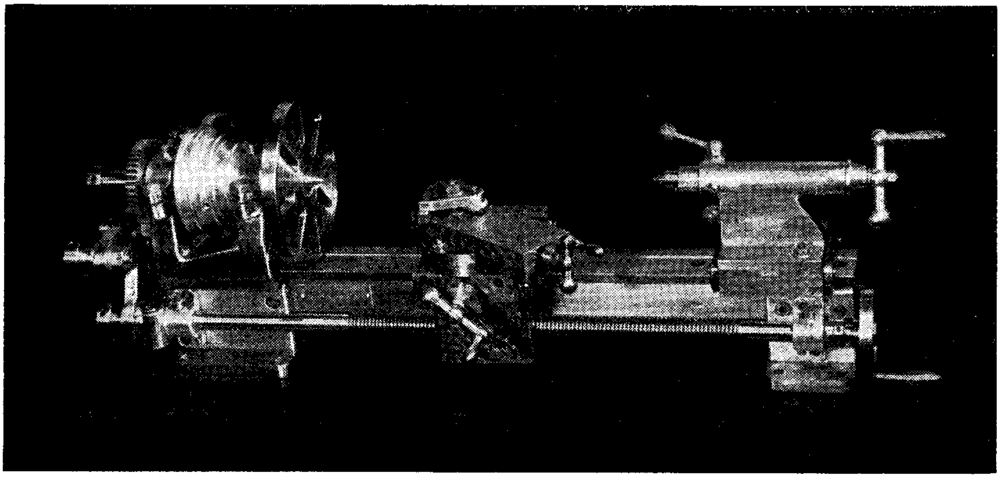


Photo by] [*Edward C. Partridge*

A YEAR or so ago, I decided to build a small centre lathe. Many fabricated lathes I had seen seemed to lack the clean features of a normal centre lathe. Therefore, my first intention was to produce a completely fabricated machine resembling somewhat the looks of a centre lathe and capable of a fairly wide range of small precision work.

The first part I made was the bed, which was built up from two strips of mild-steel bar. After many hours with hacksaw, file and scraper, I managed to get two sides parallel and flat. The next point that puzzled me was how to get the other sides parallel with the first, as we can see that having a V-shaped bed, it was necessary to get the sides parallel and also each side parallel with the top of the bed. I suddenly had an idea. The bed ends were marked off from the finished sides, centred and placed between centres in my 3 in. lathe. It was now possible to check the unfinished sides after checking the finished side parallel with my lathe, and so find the existing error. This was corrected with a file and scraper after many hours of filing, scraping, checking and re-checking between centres. It took about three weeks of spare time to produce the bed. I may mention that this was the first job of any size I had made requiring accuracy over a large area.

I then bolted the two strips together with Allen screws. I may say that the bed was relieved to a depth of approximately 0.050 in. down the centre before completing scraping.

The base stands are made from duralumin from two blocks milled through to fit the bed, and fixed with Allen screws.

The headstock is fabricated from pieces of mild-steel plate cut out to the required shape, screwed together and brazed all round the joints after chamfering all edges to ensure a good joint of brazing.

The tailstock was made up from round bar plate, fabricated, screwed and brazed. One side of the side plate fits under the bed and is dowled to form half of the dovetail. The other side is a loose plate running in two dowel pins and is used to give a quick action locking lever.

The tailstock is fitted with a set-over, running in two tennons to ensure parallelism at all settings.

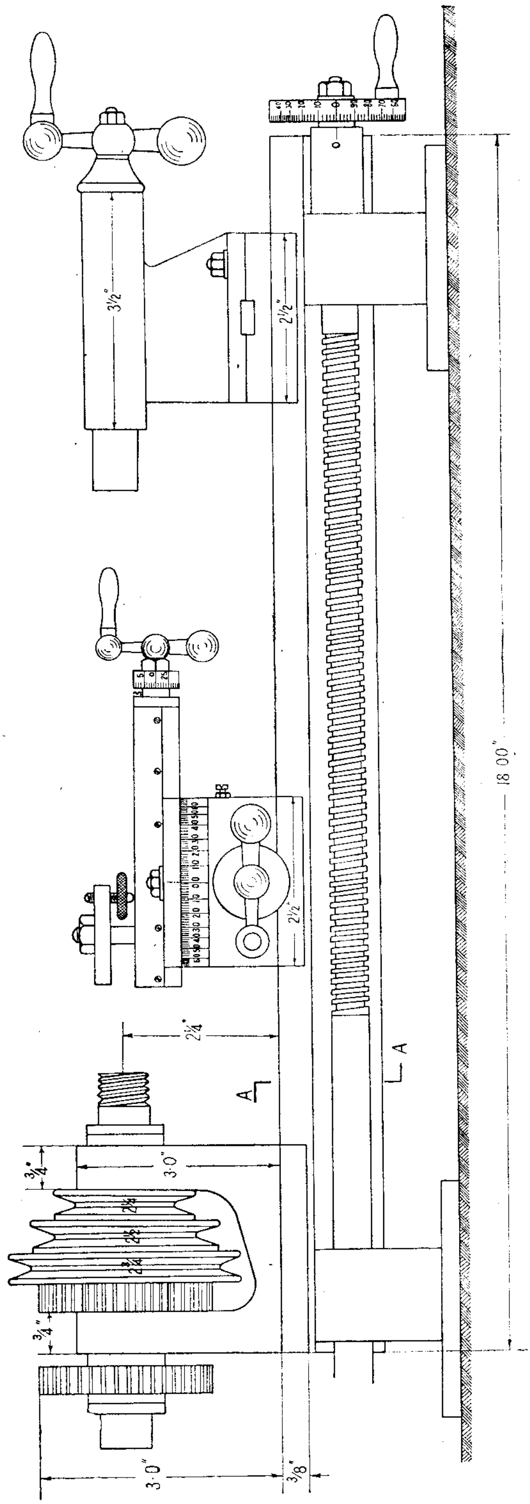
The tailstock and headstock were then bored on my 3-in. lathe, being fitted on the saddle and using a boring bar between centres to ensure a good parallel bore.

Back-gears fitted to the headstock gear were cut with a flycutter made by using a change wheel from my lathe as a pattern for the tooth form. The headstock mandrel is $\frac{7}{8}$ diameter bored to take a No. 1 Morse taper, also the tailstock barrel.

A quadrant is fitted to the headstock to fit change wheels on for screw cutting. The leadscrew is $\frac{5}{8}$ in. diameter 10 t.p.i. acme R.H.

My object for this thread was to get dimensions of 1/10th in., etc., easily on the traverse, although the R.H. thread gives anti-clockwise rotation of the traverse handle when turning to the chuck; the index is compensated for this. My reason for R.H. thread enables a straight gear train to be put on without a tumbler gear being fitted to make the leadscrew rotate the correct way when screwcutting. I find when modelling, that a good policy is to thread model components with two or three standard threads: e.g., 40 t.p.i., 32 t.p.i., 26 t.p.i., so I shall only make up the necessary gears for my method and use my 3 in. lathe for all the other thread work.

At present, the leadscrew nut is fixed, as I

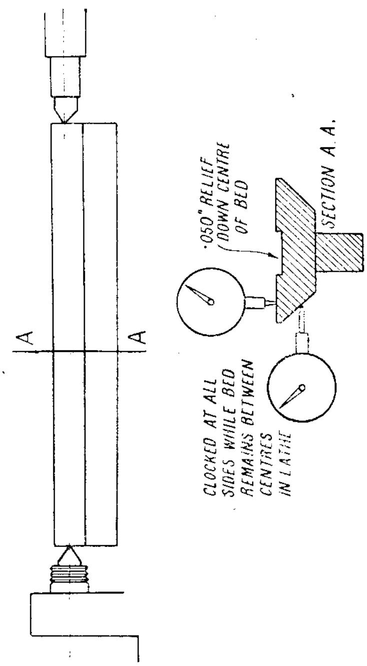


wanted to use the lathe for boring the headstock mandrel taper, also the facing of the faceplate, etc. Later on, I intend to fit a clasp-nut and chasing dial.

All indexing of the slides was carried out on a home-made dividing head. The numbers were stamped with number stamps. The advance on all slide indexing is 0.001 in. per division. The cross-slide has T-slots cut with a Woodruff cutter so that milling, etc., can be carried out on the slide-table.

The compound slide has a 360 deg. protractor fitted, which was also graduated in my home-made dividing head.

Leadscrew bearings and headstock are phosphor bronze of the plain type.



Method used to check bed for parallelism of all sides of slide surfaces

Engagement of the belt pulley to the mandrel spindle is by grub-screw fitted in the pulley, which engages in a dimple in the spindle. The back gears are engaged by cam operation and the cam is fitted with a locking-screw to ensure the gears do not jump out of mesh. The completed lathe will take approximately 10 in. between centres and has a centre height of 2¼ in. Weight is 26 lb.

This lathe was hard work with various hand tools, taking just one year to complete. It gave me many hours of enjoyment, and I may say here, was a first-class exercise in patience and the use of a hand scraper. The saddle-slide and tailstock have felt pads fitted over the bed to protect the slides from swarf—an essential detail in any lathe and even more so in one fabricated from mild-steel. I have never regretted the day I decided to make this lathe, as it has opened up a further field to me of all the accessories I now want to make for it.

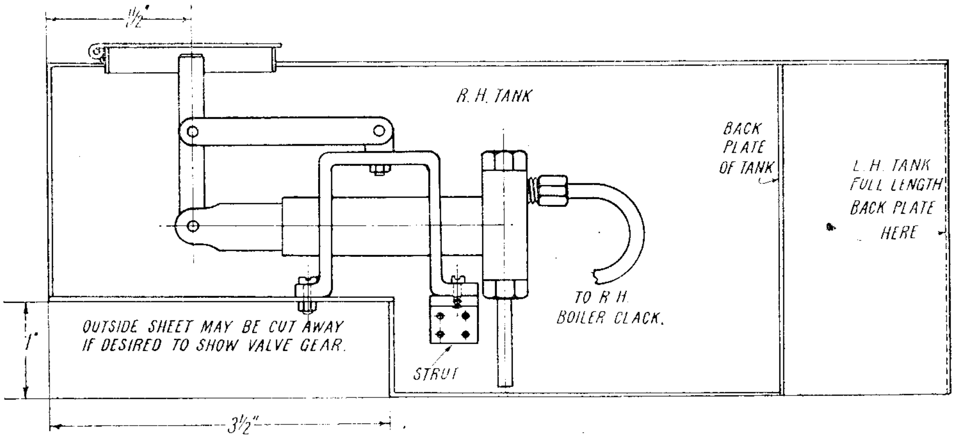
"JULIET" WITH OUTSIDE VALVE GEAR

by "L.B.S.C."

Tank Alterations

ON the original engine with inside valve-gear, the tanks were flush-bottomed, as there were no projections above the running-boards; but on the Baker-geared version, we have to arrange clearances in the side tanks and running-boards. I have already mentioned that the latter will have to be wider; so anybody building the outside-valve-gear job, and starting from scratch, should make the buffer beams 7 in. long, and the running-boards $2\frac{1}{16}$ in. wide, full length of the engine. Builders already having a chassis with $6\frac{1}{2}$-in. beams, should taper out the running-boards from the beam to the cylinders; this is frequently done in full-size, to allow more clearance when passing curved platforms, loading wharves, and other obstructions. The running-boards could be rounded off at the back end, to meet the beam, and the bunker sheet curved to suit, making a nice neat job. Clearance will, of course, have to be cut in the running-boards to clear the upper part of the valve-gear assembly; but no drawing is needed for this, because the easiest and best way to do the job, is to "offer up" the running-boards to the chassis, and mark the bits that need cutting away, which can be seen at a glance. The running-boards are attached, same as on the original engine.

Some full-sized tank engines with an outside valve-gear extending above running-board level, have a section of the side tanks cut completely away, exposing the whole gear to full view, and rendering it easy for the driver to oil up. *Juliet* builders can follow suit if they so desire, cutting a section $3\frac{1}{2}$ in. long and 1 in. high, from the front end of each side tank sheet, as indicated on the drawing. The bottom of the tank is then formed with a "step" in it, the underside of the step coinciding with the opening. Alternatively, the side sheets of the tank can be left as originally shown, and the stepped bottom fitted inside. There is nothing complicated about the job. All you have to do is to bend the strip of metal which forms the bottom of the tank to the shape and dimensions shown, instead of leaving it flat; and it is attached by pieces of angle, in a manner somewhat similar to the flat one, the joints being soldered over to render them watertight.

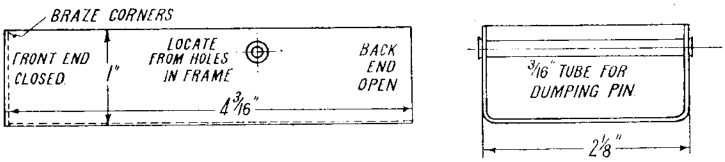


Section of R.H. tank, and how to erect hand pump

The tanks will, of course, be wider, same as the running-boards, this being a good feature, and not only increasing the water capacity—despite the space taken by the valve-gear clearances—but adding to the adhesive weight. The overall length is $9\frac{1}{4}$ in. as before, and the height $3\frac{1}{2}$ in., but the width is increased to $1\frac{3}{4}$ in., as shown in the cross-section. The right-hand tank is shorter, to allow clearance for the reverse lever, as on the original; but the outside sheet is full length, and the tops are cut away for clearances, as shown on the original drawings. No alteration to the cab will be necessary.

New Position for the Hand Pump

It won't be possible to fit the absent-minded engineman's insurance policy in its original position, on account of the step in the tank bottom ; but that doesn't matter a Continental, because it is easy enough to mount it on top of the step. This involves two minor alterations. The first is, to shorten the operating lever, so



Details of the ashpan

that it won't project through the filler hole ; that is easily done, and makes no difference to the pump being used, if needed, as the extension handle fits over the shortened lever easily enough, and the leverage isn't appreciably affected. Item No. 2 is to provide a support for the lug or foot of the pump-stand that overhangs the step. All you need for that, is a strip of metal about ½ in. wide and 3/32 in. thick (⅛ in. if you like) bent over at each end like the pump stays I sometimes specify for fitting between the frames. This is fitted between the inner and outer tank sheets, as shown in the illustrations ; the easiest way is, to put it in before the bottom is put on, but it can also be fitted from the top without any trouble, as it doesn't make the slightest difference if the flanges are up the other way, as long as the part on which the pump lug will rest is level with the top of the step.

As to the pump itself, fit the delivery union in the upper part of the valve-box, if you prefer an easier pipe bend than that shown in the cross-section of the tank. Some folk have difficulty in making a sharp bend in small copper pipe, without kinking it. The pipe runs to a double union in the front end of the tank, same as shown in the original drawing of the flat-bottomed tank, and thence to the right-hand clack-box on the boiler barrel.

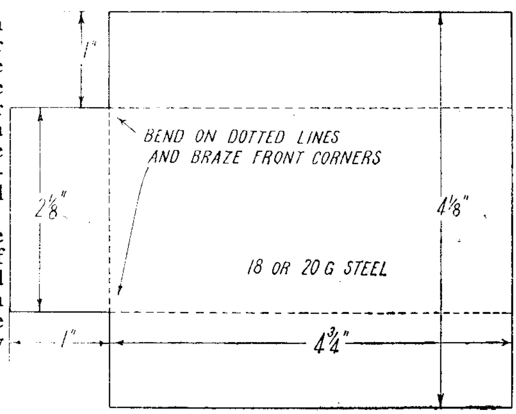
Instead of cross-slotting the bottom of the suction-valve seating, silver-solder a piece of 5/32-in. copper pipe into it, as shown ; this should be about 1 in. long, so that it reaches to the bottom of the tank. Reason for this is obvious ! The tanks are fitted to the running-boards in the way specified for the original engine.

Ashpan

On *Juliet No.* 1, a sloping ashpan was specified, as the rear axle carried the eccentrics for the inside valve-gear, and the boiler feed pump. On No. 2, the axle is clear, and well below the bottom of the firebox ; so we can take advantage of this, and fit a much deeper ashpan of rectangular shape. This can be made from 18- or 20-gauge steel, or anything else you have handy ; stout tin would do quite well. Speaking of tin, folk often deride things made of tin, maybe because the term "tinpot" has become associated with anything shoddy ; but is it just another case of "give a dog a bad name." Young Curly's tin boilers—he couldn't afford to buy brass or copper—stood up wonderfully well, and when they became pin-holed through rusting, were easily replaced. Incidentally, it is funny how things become "twisted" through popular usage ; for example, you hear people speak of "tintacks." *There are no such things* ! Did I hear somebody laugh ? O.K.—well, go and ask your local ironmonger. He will tell you that he can supply *tinned* tacks, or black tacks ! The former are silvery bright, the latter are what their name implies ; both kinds are made of iron. Neither you, nor myself, nor anybody else, has ever met a tack made of tin. I'll bet that has caught out a few of the friends and relations of Mr. I. Knowitall ! Most folk are aware that commercial "tin" is merely iron with a thin coating of tin over it.

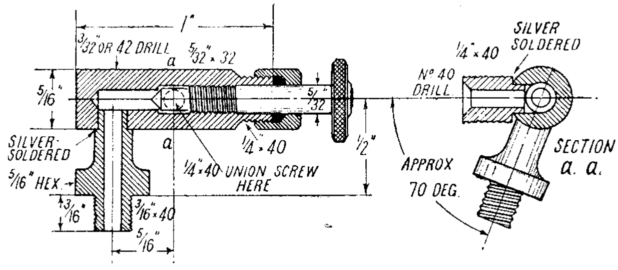
Construction

Getting back to the ashpan job, a piece of metal measuring $5\frac{3}{16}$ in. × $4\frac{1}{8}$ in. will be required. Mark it out as shown in the illustration, cut out the two 1 in. corners, bent on the dotted lines to right-angles, and braze the corners. I gave



Ashpan "in the flat"

instructions in the original notes, on how to locate and drill the holes for the supporting-pin, in the main frames. After drilling these, put the ashpan in place, and hold it up tightly against the bottom of the firebox, so that it keeps the grate in place. Run the No. 30 drill through the holes in frame, holding the drill-brace so that the drill is square with the frames, make counter-sinks on the ashpan sides. Remove the ashpan, drill the holes $\frac{3}{16}$ in., and put in a piece of $\frac{3}{16}$-in.



Injector steam valve

tube, as a guide for the retaining-pin, or the dumping-pin, as it is more frequently called. It may possibly collect other names if you try to pull it out before the engine has cooled off after finishing a run. Bell the ends slightly, both to guide the pin into the tube, and to prevent the tube coming out. The pin is made as given in the previous instructions, from $\frac{1}{8}$-in. rod, with a turned head or button screwed on.

Injector

On the drawing of *Juliet No.* 2, I showed an injector fitted on the left-hand side, under the running-board, just below the cab. This was in response to querists who wanted to know if an injector could be fitted, or was the boiler too small for such an accessory. If the injector is properly made to my specifications, it will feed the boiler without " knocking it stony," as the enginemen would say. If there is a good fire, it would just about stop the safety-valve blowing off, and that's all. As I have fully described fairly recently how injectors are made, there is no need for repetition here ; but those who have the *Live Steam Book* can follow the instructions given therein, putting the water-union screw underneath (alongside the overflow pipe) instead of at the side. If the water is good in your district, and doesn't fur up the domestic kettles (good test, that) use No. 67 drill for the steam cone, No. 72 for the combining cone, and No. 76 for the delivery cone. If the water is hard, and leaves a lot of scaly deposit, or sludge, use the combination 63-70-75 ; this allows the injector to work even after the cones have become a little furred.

Steam and Water Connections

As the gadget only weighs about an ounce or so, the pipes hold it in place ; and it can be removed for cleaning in a matter of seconds, as there are only three union nuts to disconnect. The accompanying drawing shows the other ends of the pipes. Steam is supplied by an angle-valve made to the dimensions given in the section, by the methods given in recent notes on boiler fittings. Use 32-pitch thread for the valve-pin, or a coarser one than that if you have suitable taps and dies, as it affords a much quicker operation than the usual 40-pitch. The stem of the valve is screwed into the top of the wrapper, just to the right of the turret ; drill and tap the hole so that it goes through the flange of the backhead and gives plenty of hold for the threads. It will be found that the valve-wheel projects under the curve of the blower pipe, and is easy to operate. I have shown the union at an angle with the stem, to ensure a neat straight run with the pipe, as shown in the backhead view ; it should clear the water-gauge fitting. The pipe goes straight down through a clearance filed in the running-board, turns at a right-angle bend, and is attached to the steam end of the injector by the usual union nut and flat collar.

The water valve is of the " drowned " type as used on some of my own engines, and gives no trouble whatever. The valve itself is made from a piece of $\frac{3}{8}$-in. hexagon rod, $1\frac{1}{4}$ in. long. Chuck in three-jaw, face, centre deeply, and drill right through with No. 40 drill. Turn down $\frac{1}{2}$ in. length to $\frac{1}{4}$ in. diameter, and screw $\frac{1}{4}$ in. × 40. Reverse, and rechuck in a tapped bush held in three-jaw. Open out the hole to $\frac{5}{8}$ in. depth with 9/64 in. or No. 27 drill, bottom with a D-bit, and tap $\frac{3}{16}$-in. Whitworth. Turn down $\frac{1}{2}$ in. of the outside to $\frac{5}{16}$ in. diameter, and drill a couple of cross holes, $\frac{1}{16}$ in. or No. 52, across the bottom, just above the valve-seat.

To save turning down a long stem, I usually make the valve-pin in two parts, the screwed part from $\frac{3}{16}$-in. drawn bronze rod, and the stem from $\frac{1}{8}$-in. rod. The end of the screwed part is drilled and tapped 6-B.A. for about $\frac{3}{16}$ in. down ; the end of the stem is reduced and screwed to suit. To prevent the two parts unscrewing, they are silver-soldered after joining. The bottom part of the valve goes through a hole in the tank bottom and the running-board, and is nutted underneath, the nut anchoring the tank as well as securing the valve. The upper part of the stem passes through a gland made from $\frac{5}{16}$-in. hexagon rod, screwed into the tank top ; solder it as well, if the threads strip in the thin metal. Fit a cross handle as shown. The union at the bottom is connected by a 5/32-in. pipe, with appropriate nuts and cones, to the water nipple under the injector.

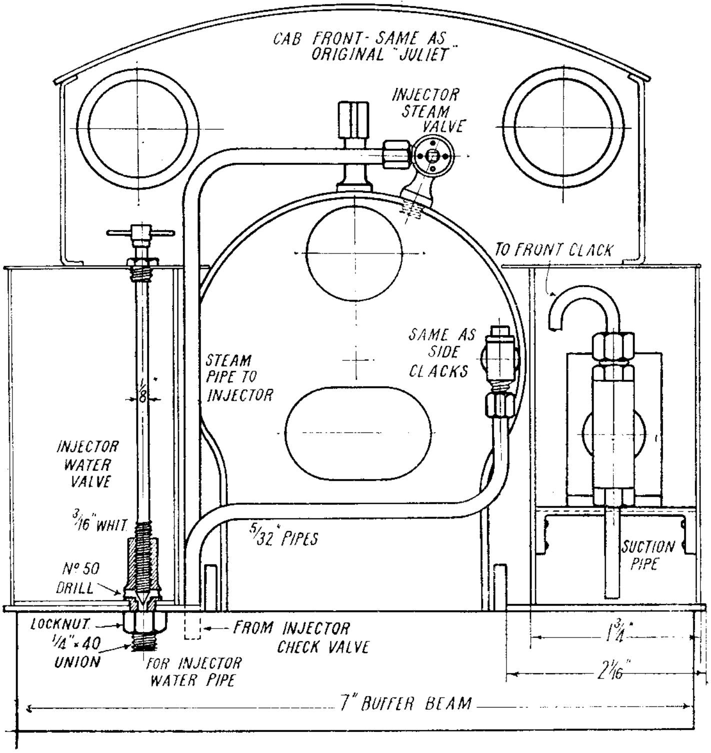
Feed Clack and Pipe

The handiest place for the delivery clack, is at the right-hand side of the backhead, about halfway down, as shown. The clack-box itself needs no description here, as it is made exactly the same as the others on the boiler barrel, near the smokebox. It can be screwed directly into the back head, the plate being thick enough without needing any bush. The union under the clack is connected to the check-valve on the end of the injector by a 5/32-in. thin-walled copper pipe with union nuts and cones on each end. Be careful to avoid any contraction or kink in the pipe when bending and erecting. Pipe friction alone is bad enough for any pump or injector to overcome, without " piling on the agony " by introducing squeezed-up places, kinks, ultra-sharp bends, and angles. It always makes me smile to recall the antics of somebody who called himself a " professional model engineer " —a term I hate and detest—and who got in trouble with a feed pump on a locomotive he

built for a one-time friend. From the connection below the drag beam, to the union under the suction-valve of the pump, a matter of less than 6 in., there were three sharp bends and two elbows, the feed-pipe being made up from odd lengths joined together. The perpetrator of this unique bit of plumbing said he didn't see that it mattered, as it served the purpose! That, of course, was a matter of opinion; but the fact remains that when my late friend asked me to assist him to get some water into the boiler, I removed the conglomeration, and substituted a straight pipe between the tender hose connection and the pump. The latter then started operations, and as far as I know, has never given any further trouble. It is only once in a while that anything goes amiss with the pipe work on my own engines, but I'm NOT a "model engineer"; I'm just a builder of small locomotives—a distinction with a whale of a difference—'nuff sed!

Warning!

A word of warning to beginners might not come amiss just here. Always see that water pipes are clean, and the tender strainers undamaged, or you may easily get a pump or injector failure through no fault of either component. Something happened to the strainer on my old *Ayesha* recently. I always use her for injector testing; and when running one afternoon, the injector (her own) started to blow steam from the overflow. Thinking it needed cleaning, I changed it for a spare, but that one did the same. I noticed that with water on and steam off, there was very little running from the overflow, so I took off the pipe, and found the trouble. If anybody who reads these notes has had their kitchen sink waste-pipe stopped up, and has cleaned out the trap, he will know the sort of stuff that accumulates in it. I found a tiny mass of the same stuff in the U-shaped bend of the water pipe, directly under the injector. On cleaning and replacing, all was O.K. once more. I found the tender strainer had split after many years, so fitted a new gauze. It just goes to show!



Extra fittings for injector

Well, I think that is all there is to say about a *Juliet* with outside valve-gear. The rest of the job, and any details that I have not mentioned, will be the same as described for the original engine; and full-size blueprints of the amendments for the outside valve-gear job, will be available from our offices very shortly. Should there be any point on which any builder of *Juliet No. 2.* requires further information, just write and say what it is, and I'll do my best to oblige, as usual, circumstances and the K.B.P. permitting.

PISTON VALVE CYLINDERS AND PATTERNS

by C. H. NOBLE, President, Wigan and District S.M.E.

THE piston valve cylinders described in this article are designed to follow as closely as possible those of a modern prototype. They will ultimately find their way into a L.M.S. 8F, 2-8-0 locomotive now being built by a member of the Wigan Society.

For some time now I have felt that considerable improvement could be made in the design of miniature locomotive cylinders ; the elimination of tortuous and restricted steam and exhaust passages, and the simplification of machining operations being the first consideration. To accomplish this, however, meant the production of the necessary fairly complicated patterns, which was beyond my limited skill as a pattern-maker. Discussing the matter with a pattern-maker member of the society at one of our recent meetings, I found that he was quite keen to see what he could make of them. He was of the opinion that there were no insuperable difficulties, and he asked me to get out drawings. I need hardly say that I was glad of the opportunity to do this, and very soon a fine set of patterns was in my possession. Here was an example of the craftsman taking pride in the skilful use of his tools ; to me the product was more than a means to an end. We were most fortunate in having a painstaking moulder, the result being several excellent castings in iron.

The machining, which was done in my own workshop, calls for no special comment beyond the careful observance of a light press-fit tolerance for the liners in the steam chest, which were lapped after assembly, as were the cylinder bores also.

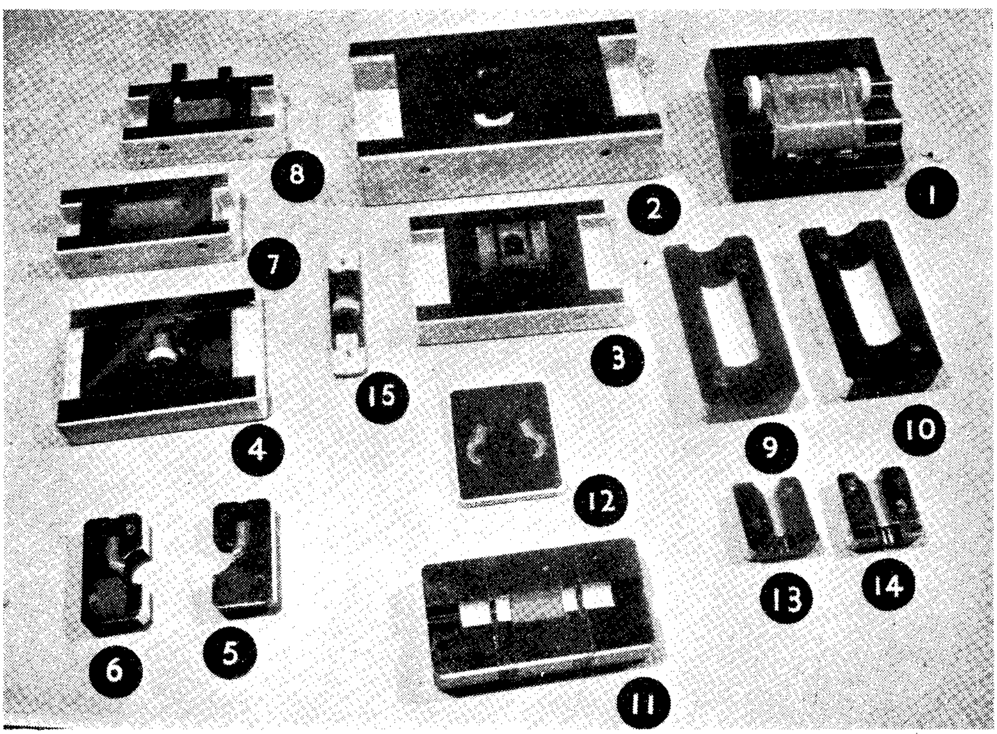
The numbered patterns, taken in conjunction with the drawings shown in this article, should give a fair idea of the layout.

Pattern No. 1 produces the mould which is a simple two-part job in which the cores are assembled.

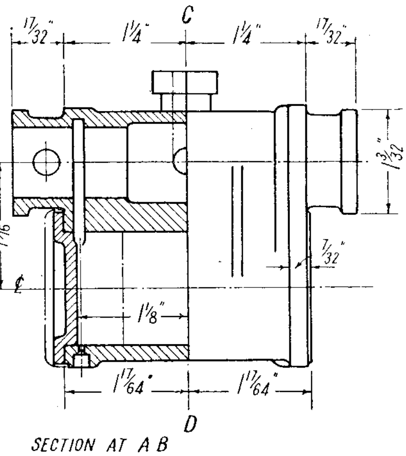
The core boxes are numbered 2 to 14.

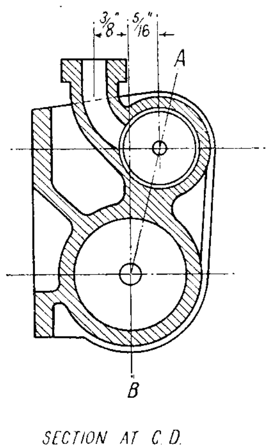
Cores from No. 2 core out the ends of No. 1 from the bolting faces of the cylinder covers to the end of the print.

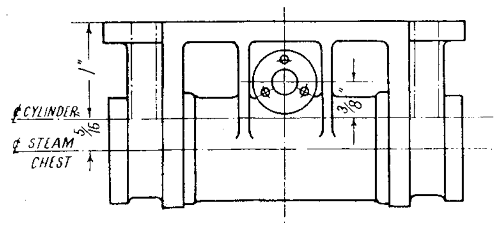
Cores Nos. 3, 4, 5, 6 are assembled and

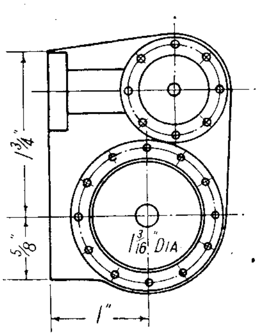


Patterns and core boxes

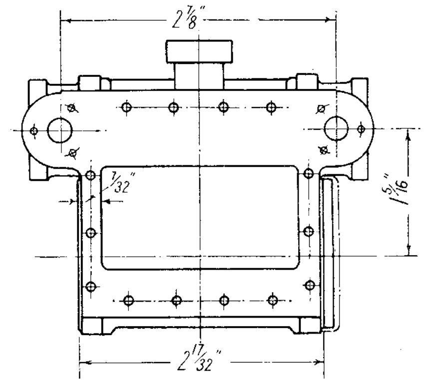








End view



Frame bolting face, showing exhaust flanges

" gummed " together to produce the top back side of cylinder and steam chest.

Core No. 7 takes out the bottom back side of cylinder.

Core No. 8 produces the recess at back of cylinder.

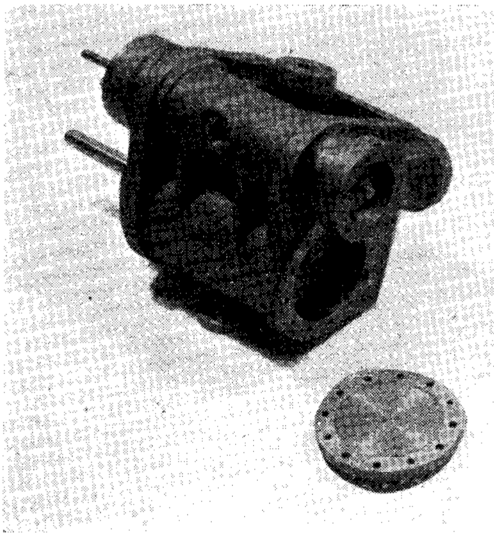
Cores from Nos. 9 and 10 make the cylinder bore.

Core No. 11, steam chest core, is made in halves. Having produced these, two pairs of steam port cores are made from box No. 12 and " gummed " into the recesses on steam chest core. The two halves are then dried out, " gummed," and assembled.

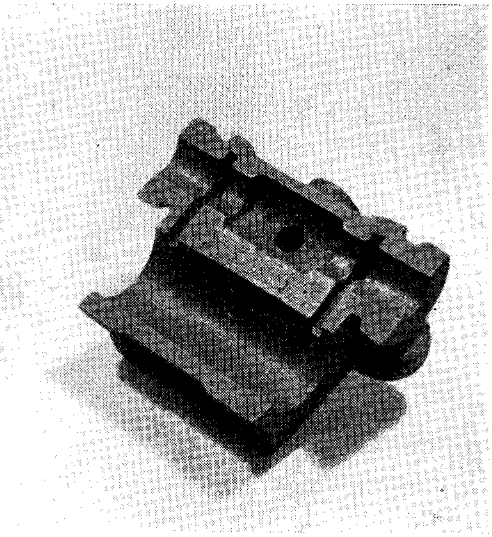
Cores Nos. 13/14 core out the exhaust passages. (It was found simpler to drill these in the finished casting.)

Core No. 15 is a loose part of No. 3 carrying half the steam inlet flange and half the steam inlet core. No. 4 is complementary to this and produces the other halves.

The reader may ask at this stage, why go to



Finished cylinder



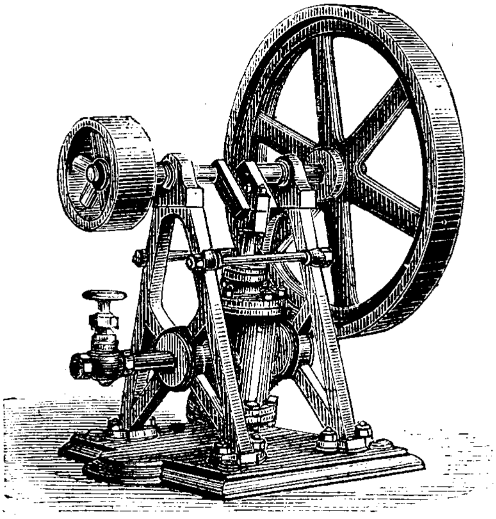
Section of cylinder as cast

so much trouble. I could give several reasons, but I will confine myself to one which I am sure will be appreciated. I remember many years ago our esteemed friend, the late Mr. Percival Marshall, remarking on the vast improvements which had been made in the design and performance of the miniature locomotive, and wondering what was in store for the future. Since then, further strides have been made, thanks to those experimenters who have made their contributions to this end. My answer, therefore, is that this article is a very humble attempt to continue the good work.

It has been a great pleasure to collaborate with Mr. N. Lowe, who is responsible for the patterns, and Mr. J. S. Christopher, who did the photography. Both members of the Wigan S.M.E., they have taken the greatest interest in the work.

AN EARLY SMALL POWER STEAM PLANT

THE old engraving shown here is taken from a book published in 1872, and depicts a small steam engine used to drive lathes and other small machines. The cylinder was 2½ in. in diameter, with a 4 in. stroke ; the fly-wheel being 16 in. in diameter with a 2 in. rim. There was no slide-valve, the oscillation of the cylinder against the steam valve-boss serving the same purpose. There were three adjusting screws in the opposite boss, to force the cylinder up against the steam boss. The speed attained was 220 revolutions per min. with 25 lb. of steam, and the total weight of the engine was about 30 lb.—C. J. ROBB.



An Adjustable Drawing Board

With Parallel-motion Straight-edge

by "Base Circle"

THE average model engineer does not, as a rule, take a great interest in drawing, but still, unless he is prepared at all times to work blindly to the drawings and designs of somebody else, he is compelled, however much against his will, to practise the art of drawing to some extent. Many people, of course, seem to derive complete satisfaction from working to designs provided by others, but to me, and I am sure to the majority of readers, there is nothing like developing one's own ideas or at least trying to improve on existing designs.

It is possible, of course, to carry on with very rough sketches—sometimes even free-hand; indeed, some pride themselves on working without drawings at all!

Well, I have seen some of these jobs done without drawings and all I can say is that they would have been done better and certainly more easily with the help of proper drawings. It is much easier to correct our errors on paper than to wait until our errors are in steel and cast-iron.

To be brief, we must all draw, so why not draw in comfort? Let us take the same pride in our drawing equipment as, say, in our lathe. An ordinary board and tee-square will certainly serve our purpose but a vertical board is very much more comfortable to use—and also very much more healthy to work at. The old-style draughtsman working crouched over his board almost invariabily suffered from stomach complaints, from which the modern worker with his adjustable board is comparatively free.

The idea, then, is to hinge the board to a base which can be laid on or clamped to any suitable desk or table and to provide the board with a parallel-motion straight-edge. The whole thing can fold up so that it can be stored in any odd corner, of the home, when not in use.

Fig. 1 shows the general idea. The board—shown in detail in Fig. 2—is an "Imperial" size one, i.e. 31 in. long by 24 in. broad. This will be found to be big enough for most people. The next standard size, "Double Elephant," 42 in. by 29 in., would be rather clumsy for home use. The board can be an ordinary commercial one or it may be built up from suitable plywood. So long as the top surface is smooth and flat, that is all that matters. There is no need to worry about absolute squareness or straightness of the sides. The board is hinged by two stout hinges to the base—also shown in Fig. 2. This base is made up from any suitable wood about $\frac{7}{8}$ in. by $2\frac{1}{2}$ in., and the parts should be glued and screwed together. The cross-pieces carrying the grooves to engage the strut had better be of oak or mahogany.

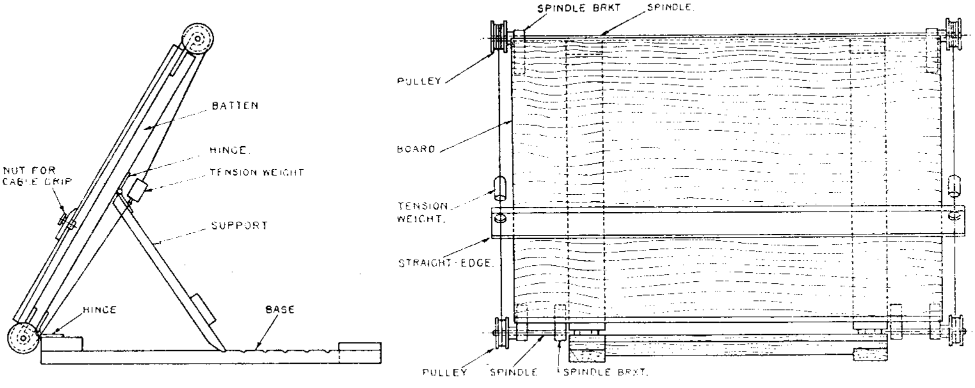


Fig. 1 General arrangement of adjustable drawing board

The support or strut is shown in Fig. 3. This is also hinged to the back of the board and the struts themselves would again be better in hardwood.

The straight-edge (Fig. 3) should be nicely finished in mahogany and the upper edge must, of course, be as straight as we can make it. Test it by drawing a line on paper with it, reversing it, and drawing another line to coincide with the first. When the lines do coincide, you can take it the straight-edge will do. The ledge screwed to the straight-edge serves as a handle and is also handy for laying pencils and instruments on.

Six brackets for the pulley spindles must be provided. These are shown (Fig. 3) as aluminium castings, but they could, if preferred, be built up from flat bar with blocks screwed, brazed, or welded on. The two top brackets, by the way, would be better to have oil-holes, though these are

not shown on the drawing. Two of the bottom brackets will have tapped holes for grub-screws to lock the spindles in place.

The spindles (also in Fig. 3) are plain mild-steel rod. The long one for the top pulleys is perfectly plain, while the two short ones have a split-pin

is only one turn of cable round them compared to four or five round the top pair.

The tension weight (Fig. 3) is, I know, very crude and I'm sure some people would like something more elegant. If so, by all means let them devise something better. The only thing to be

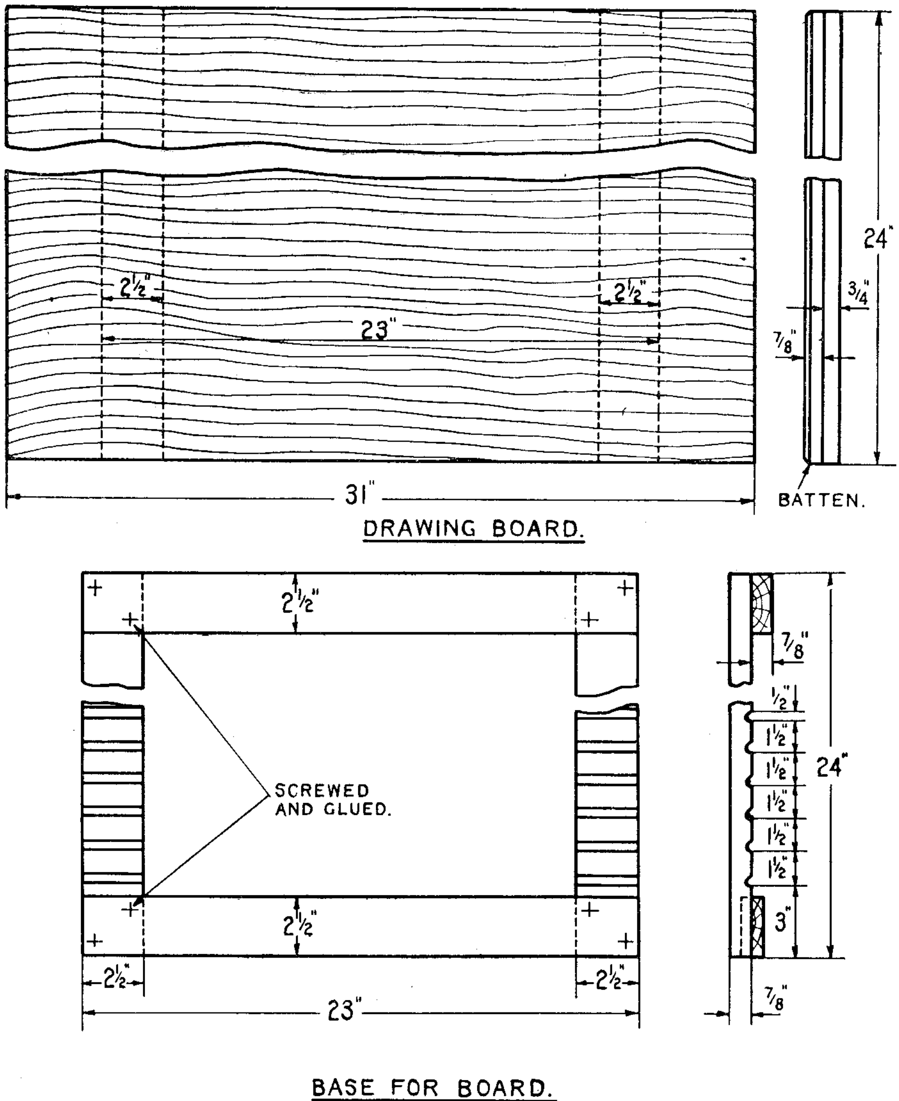


Fig. 2

hole at one end—a split-pin and washer serving to retain the pulley.

The pulleys (Fig. 3) are shown as in brass or cast-iron. I'm afraid aluminium would not be very suitable, as the cables would probably wear the surface rather badly. The pulleys are shown as being all the same, but the bottom pair could certainly be much narrower, as there

said in favour of the device shown is that it is easily made. One end of the cable is tied to the eye-bolt and the other is locked in the 3/32 in. hole. The tension in the cable is adjusted by means of the knurled nut.

All that remains now is to provide means to clamp the straight-edge to the cable. The cable grip (Fig. 3) is a simple piece of turning. The

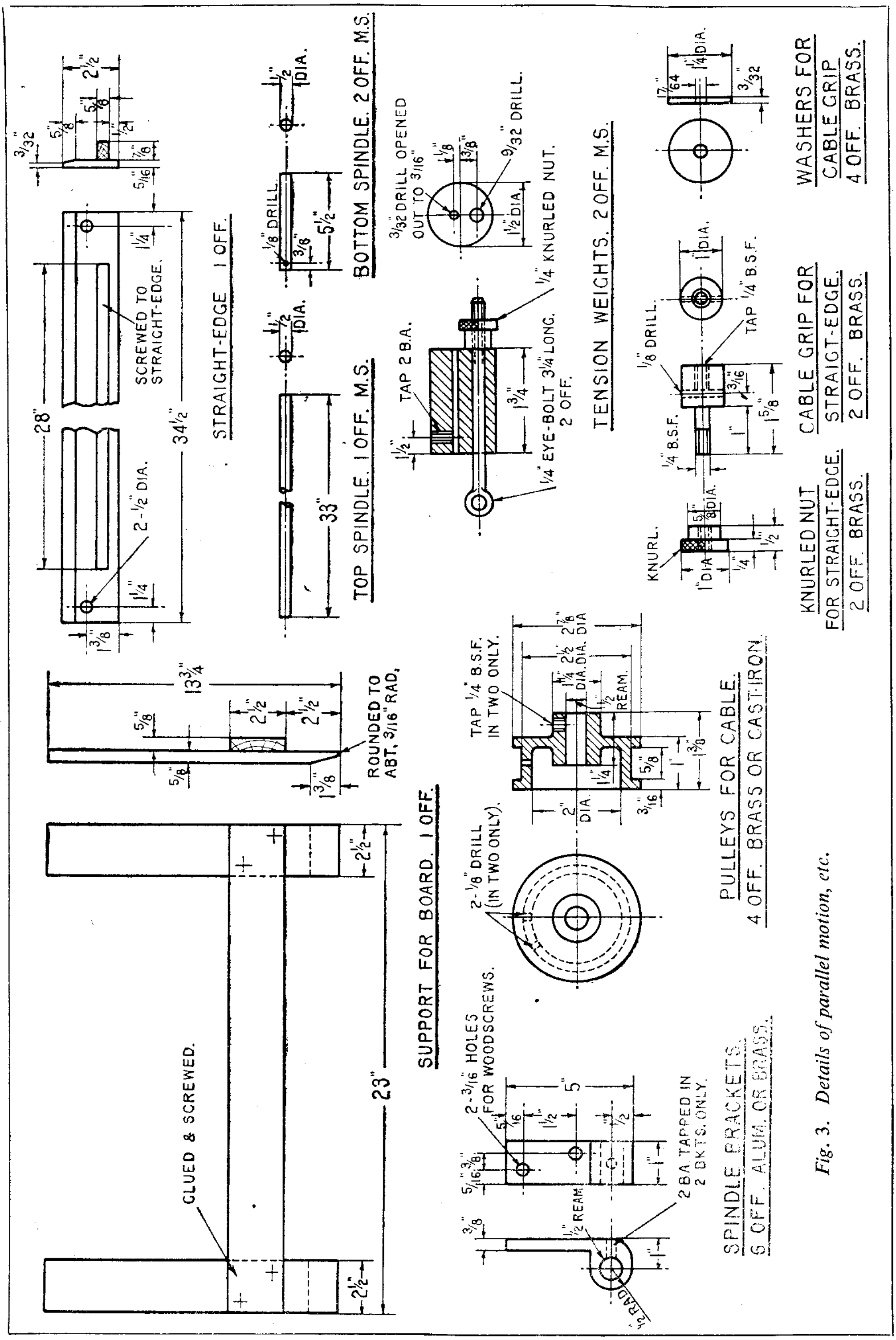


Fig. 3. Details of parallel motion, etc.

cable passes through the $\frac{1}{8}$ in. hole and is locked by the grub-screw. The $\frac{1}{4}$ in. end of the grip passes through the $\frac{1}{2}$ in. holes in the straight-edge—the large holes provide a convenient adjustment when lining up the straight-edge to an existing drawing already pinned to the board. Large washers are used above and below the straight-edge.

When the board has been mounted on the base-board and the spindle brackets have been screwed to the back of the board, the parallel motion is assembled as follows :—The long spindle is threaded through the top brackets—make sure that it runs freely—and the two pulleys with the small $\frac{1}{8}$ in. holes are grub-screwed firmly to the spindle with the $\frac{1}{8}$ in. holes approximately in line. The bottom pulleys are also assembled on their spindles, making sure that the top and bottom pulleys are reasonably in line. A length of cable—ordinary $\frac{1}{16}$-in. Bowden cable—is threaded through the $\frac{1}{8}$ in. holes in each upper pulley, i.e. in through one hole and out through the other. Then with the straight-edge right at the bottom of the board, the cables should be nipped at either end in the cable grip. The cable then passes round the bottom pulley and up to the tension weight which should be up near the top pulley. It should be fastened to the adjusting screw—leaving plenty of adjustment on the screw. The other end of the cable which comes from the top pulley should be wound four times round the pulley and then led to the tension weight and fastened by the grub-screw.

With a little bit of adjusting and manipulation here and there, it will be found that the straight-edge moves freely up and down the board and—provided the two top pulleys are of exactly the same diameter—its motion should result in a line drawn near the top of the board being exactly parallel with one drawn near the bottom.

I am quite sure that once you become accustomed to a board like this, you will wonder why you put up with the old board and tee-square so long. Drawing may even, who knows, become a pleasure!

There are one or two refinements which some readers might consider worth fitting. One is to add flat spring clips to hold the straight-edge in contact with the board. Personally, I don't like them, as they make it more difficult to clean the under surface of the straight-edge. Another idea is to have a spring to locate the straight-edge on the board endwise. I think if the cable grips in our case are nicely adjusted, they will be found to serve this purpose quite well without any further additions.

Finally, let me forestall criticism by saying that no originality is claimed for this design. Drawing boards generally similar to the one described are on the market now and have been for many years. All that has been done is to simplify the details to make the job as easy as possible.

For the Bookshelf

Model Boat Construction, by Harvey A. Adam. (London : Percival Marshall & Co. Ltd.) 102 pages, size 12 in. by 9¼ in. Fully illustrated. Price £2 2s. 0d. net.

In our opinion, this is one of the most practical and informative books of its kind, and the main basis of its text is the author's insistence upon the application of full-size principles which, after all, form the firmest foundations on which to build any model. Also, the book treats of the building of *boats* and not ships, the justification for which distinction is fully and convincingly explained by the author.

The text, after an opening chapter in which the subject is discussed generally, is arranged in a largely progressive order through twelve further chapters, beginning with one dealing with the choice of materials ; in this important matter, the reader who, we hope, is a prospective model builder, is given an abundance of sound practical advice.

There is a chapter on the fabrication of metal fittings, such as anchors, bollards, cleats, fairleads, ensign sockets, lamps and the like ; another discusses such matters as engine bearers, exhaust systems, fuel tanks and couplings ; then comes one in which the forms of propellers and rudders are explained and a simple steering device is suggested. Nor has the making and use of drawings been overlooked ; for in boat building, drawings are probably more important than they are for almost any other kind of structure. A brief, but highly informative chapter giving information as to how a model boat should be painted and finished brings to an end the more practically instructive part of the book ; the succeeding chapters describe different types of model boats in all their essential detail.

The size and shape of this book may not, at first, meet with the approval of readers ; but it is fully justified by the splendid manner in which the illustrations, especially the numerous line drawings, are presented. Many are full-page size, and two are double-folded plates ; detail drawings have mostly been collected together on whole pages. The halftone reproductions are about equally divided between prototype and model boats, not always to depict various types, but also to show some indication of the behaviour of each when moving on the water ; these illustrations are particularly instructive. One or two photographs of models at rest on the water are remarkably realistic and convincing, the kind which set a standard at which all photographers of models should aim.

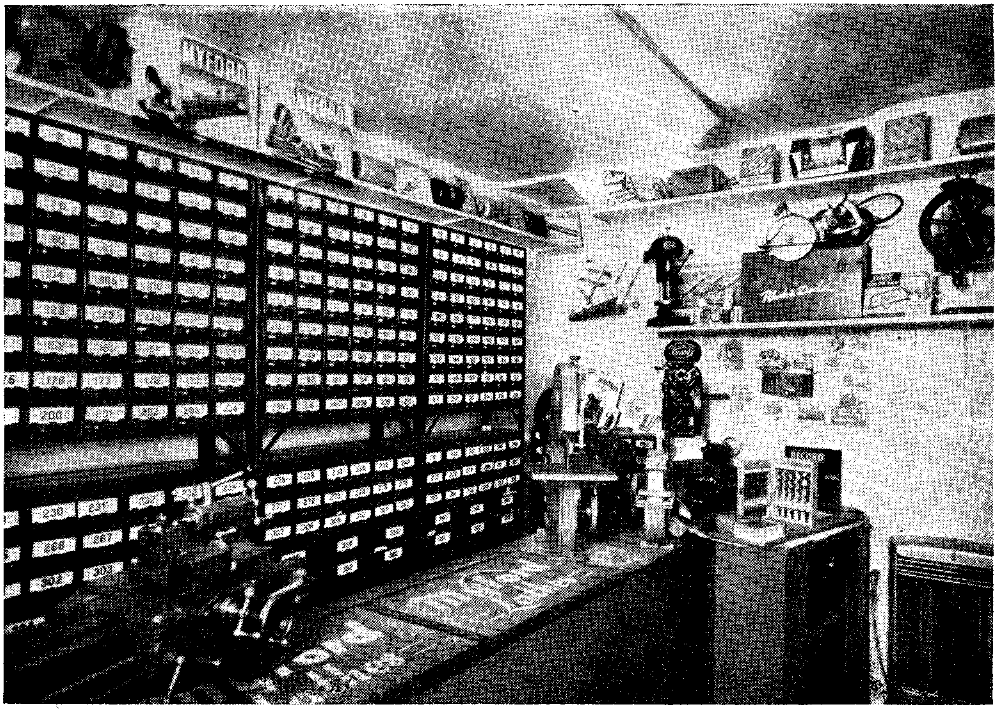
A glossary of useful technical and marine terms occupies a page and a half, while the final pages are devoted to a comprehensive index and a list of the various drawings. We have no hesitation in recommending this book to all who are in any way interested in building model boats.

Garner's New Branch Establishment

IN the comparitively short period since the end of the war, the name of Messrs. T. Garner & Son Ltd., of Barnsley, has become almost a household word among model engineers and all users of engineering tools. The rapid expansion of both mail order and counter business has resulted in the opening of a new branch establishment at Primrose Hill, off Sheffield Road, Barnsley. As will be seen from the photographs, this is fully equipped for efficient service and a new ledger index routine for dealing with stocks and orders furnishes a means of dealing speedily with all orders. Practically all leading makes of machine tools and hand-tools are stocked. The location of the shop is in the centre of Barnsley, yet away from the main street traffic, and in view of the fact that most industrial workers nowadays have Saturday available for shopping, this establishment is open all day on Saturdays.

Enthusiasts will be given a hearty welcome at any time.

The outside—



—looking in !

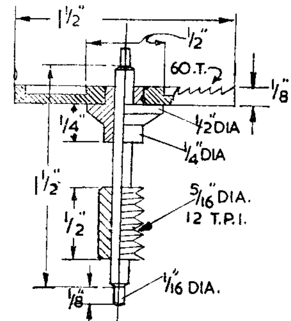
*A Half-seconds Electric Clock

by C. R. Jones

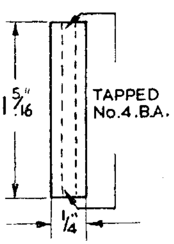
IN the present case, the pillars were made from brass rod $\frac{1}{4}$ in. in diameter, but steel could be used.

Centre Wheel "K"

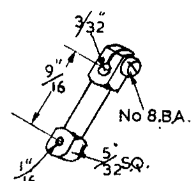
The centre wheel in this clock is identical with the one in the previous clock, with the exception of its position on its spindle. It is 1 19/32 in. in diamter, and has 60 teeth, cut at an angle of 55 deg.



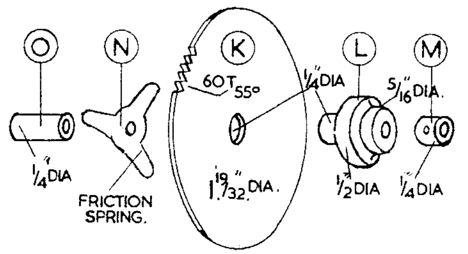
COUNT WHEEL & SPINDLE.



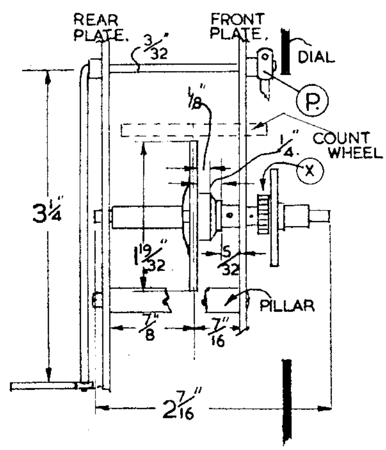
PILLAR 3.OFF.



OPERATING LEVER (P)



CENTRE WHEEL



CENTRE WHEEL ASSEMBLY.

The centre wheel assembly is shown on the appropriate drawing, and it will be noticed that the wheel is brought further forward, in order to bring the teeth of the count-wheel outside the front plate (count-wheel shown dotted.)

The assembly of the count-wheel and its spindle is similar. (See previous article.)

The crutch spindle is shown on the centre wheel assembly drawing, and was made from silver-steel 3/32 in. in diameter bent at a sharp right-angle; the long arm being $3\frac{1}{4}$ in. in length, and the other part being left sufficiently long to go through the 3/32 in. holes in both plates, and the operating lever *P*, room being left for two collars 5/32 in. in diameter and $\frac{1}{8}$ in. in length, drilled 3/32 in., one being placed against the angular bend and the other behind lever *P*.

On the lower end of the long portion a small fork made from $\frac{1}{16}$-in. brass was sweated, having a slot $\frac{3}{16}$ in. to engage with the pendulum-rod.

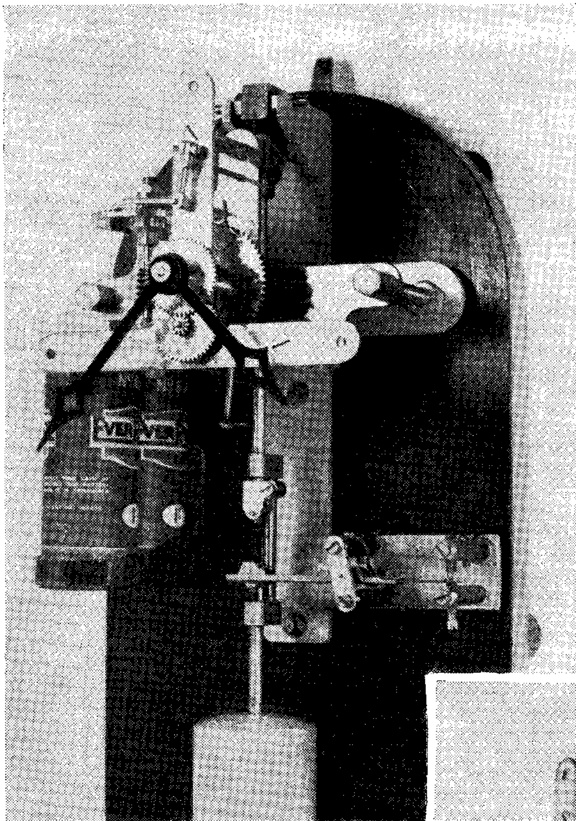
Operating Lever "P"

The operating lever was made to the sizes shown, from a length of square silver-steel, all the holes being drilled first, and the centre portion being then turned down to about $\frac{1}{8}$ in. in diameter.

The ends were rounded off, and the top end tapped for a No. 8 B.A. clamping-screw, after being split as shown.

It was then polished on an oilstone.

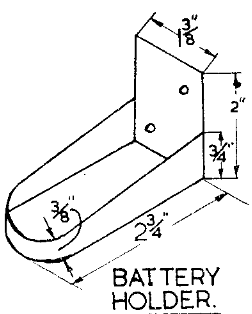
*Continued from page 741, "M.E.," June 5, 1952.



Photograph No. 4. *Wheelwork with dial removed*

Battery Holder

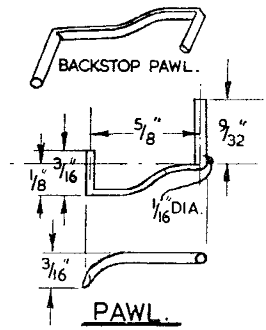
This was made from stout tinplate, and soft-soldered together.



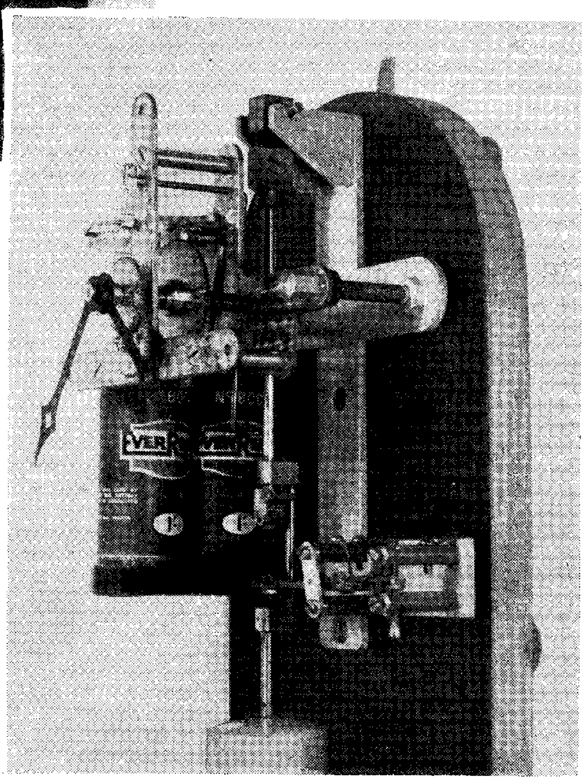
Backstop and Operating Pawls

These were made from $\frac{1}{16}$ in. diameter silver-steel, the backstop pawl being made to the dimensions shown, and the operating pawl being similar, except that its length is about $\frac{7}{8}$ in., and it is flat on the front surface.

The long arm of the backstop pawl goes through the $\frac{1}{16}$-in. hole in the bracket before described, and the long



arm of the operating pawl through the hole $\frac{1}{16}$ in. in diameter in the operating lever, both pawls working freely in these holes. They were retained in place by means of small brass collars about $\frac{1}{16}$ in. in length and $\frac{1}{8}$ in. in diameter, were drilled with a $\frac{1}{16}$ in. diameter hole, and split with a fine saw,



Photograph No. 5. *Another view of the wheelwork*

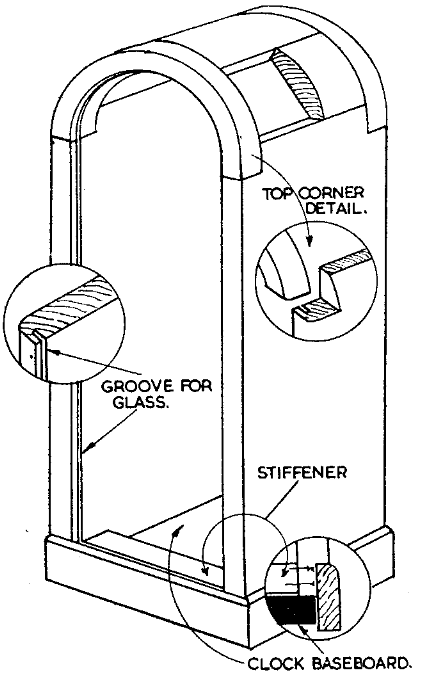
after which they were slightly squeezed in and pushed on the protruding ends of the pawls and retain them in position satisfactorily.

The Dial

This was made from brass, is 6 in. in outside diameter, the opening in the centre being 3 in. in diameter.

As will be seen from the photographs, the dial is practically identical with the dial on the last clock, the Roman numerals being slightly smaller in size.

It was produced by the same methods as the last, and was finally silvered, the method of fitting to the wheelwork being the same.



DETAILS OF CASE.

The dial mountings are not shown in this case, but they are similar, their length being ⅜ in. instead of ½ in.

Assembly

The assembly was similar to the last clock, and the approximate position of the count-wheel bracket is shown by the dotted line on the drawing of the backplate.

This bracket was fixed to the backplate by means of two No. 6-B.A. cheese-headed set-screws threaded into the bracket, with suitable clearance holes in the backplate, these holes being slightly slotted to enable the worm to be adjusted in or out of mesh with the centre wheel.

The worm was run together with the centre wheel, with "Globe" metal polish and oil, as described in my last clock article in the "M.E."

The motion wheels for working the hour hand, which is geared down 12 to 1, were made in a similar manner as before. The pinion which goes on the centre spindle, was fixed differently, however, it having a boss about ⅛ in. long, which was drilled, also the spindle, and the wheel was secured in position with a 1/32-in. pin slightly tapered (see "X" centre wheel assembly).

The wheel which meshes with this pinion, was mounted on a pin 3/32 in. in diameter, which was riveted into the front plate, and was secured in a similar manner as previously described.

The hands were made from clock spring, and brass collets made as before.

The wheelwork was fixed to the main frame, by means of two studs which were screwed into *B* main frame, and locked with two nuts, the wheelwork being secured to the outer ends of these studs by means of two nuts, and two brass cap-nuts as before.

The clock having been assembled and properly wired up, the battery holder being fixed to the left of the wheelwork, it was put into operation, the pendulum having been running satisfactorily for some time.

Some adjustments were found necessary to enable the operating pawl to pick up one tooth at a time, mainly by altering the swing of the pendulum, by means of the trigger blocks position; also, by means of slight adjustments to the angle of the operating lever and pawl. After a good deal of experimenting, it was found that the wheelwork ran best when it was adjusted so that with the pendulum at rest, the backstop pawl resting against the vertical side of one tooth, and the operating pawl resting against the vertical side of a tooth nearest the front of clock.

Also, with the pendulum having a swing of about 1½ in.

The Case

It has been thought desirable to say a few words on the construction of the case. Some apprehension was felt at first as regards to the construction of a case with a rounded top, but after considering ways and means it was made in the following manner.

A mahogany table top ¾ in. in thickness which had been stored up for such a purpose was the material used.

A piece of this was mounted on the faceplate of the "Myford" and a ring was turned up, the inside diameter being the same as the width of the backboard, a groove being also turned to accommodate the glass; the outside diameter being the same as the outside width of the case.

The ring was then cut in halves diametrically, one piece was to be used for the front of the case, and one for the rear.

The piece used for the rear had a glass groove in as well, but this makes no difference and does not show.

The sides were then made and cut away (as shown in top corner detail) to accommodate the ends of the semicirular pieces.

The lower ends of the sides were rebated (see lower detail) to take the plinth.

A piece 1 in. in width was fixed as shown to

(*Continued on page* 810)

Novices' Corner

A Workshop Rectifier

BEFORE the public electricity supply became almost entirely a.c., many workshops were equipped with small machine tools, such as lathes, drilling machines and grinders, driven by d.c. motors. Where the motor is a separate unit, conversion can, of course, be made by merely changing the motor, but in grinding machines the wheels are often attached directly to the armature shaft, and the machine itself then becomes useless for working from an a.c. supply, unless the motor is of the universal type. However, this difficulty can be overcome by installing a metal rectifier.

When a town or district altered its electricity supply from d.c. to a.c., compensation was made by changing d.c. motors for those of the a.c. type, and the displaced motors were then sold locally quite cheaply.

Advantage was taken of this change-over to buy several, almost new, best quality motors at very small cost. The reason for this seemingly reactionary policy was that, as the workshop was already equipped with d.c. motors, the new motors would serve as spares or could be used to drive additional machines. At the time, the district in which the workshop was situated had a private d.c. supply, but a move into an a.c. district was to take place in the near future. This being so, it was decided that it would be much cheaper to go on using the d.c. motors and fit a rectifier to meet the new conditions.

Although d.c. motors need a little more attention, as their commutators have to be kept clean and in good condition, they have the advantage of a low current consumption both at starting and when running. It should also be taken into account that second-hand or displaced machine tools, such as drilling machines, when fitted with d.c. motors, can often be bought quite cheaply.

Installing a Rectifier

As the cost of the rectifier for the normal voltage depends largely on the current output, the capacity of the installation should be restricted as far as possible by fitting a rectifier designed for supplying only one ¼ h.p. motor at a time. To comply with these conditions, a small, selenium rectifier was obtained from Messrs. Partridge, Wilson & Co. of Leicester, who also gave valuable advice as to the most suitable unit for the purpose.

The diagram, Fig. 1, shows that the rectifier consists of two units, wired together so as to form a complete bridge in order to give full-wave rectification. As the rectifier with its connections is alive, it should be boxed in for safety.

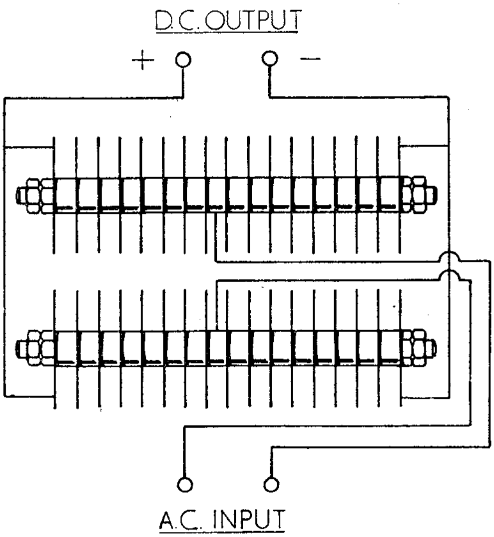


Fig. 1. Showing the construction of the selenium metal rectifier

The two units are mounted on an insulating base, and the cover is made up as a hardwood framing with perforated zinc windows to provide ventilation. It will usually be found best to fix the unit to the underside of the bench top, where it can be safely housed away from lathe turnings and bench filings.

For the convenient and safe working of the rectifier, several additional fittings are required, as represented in Fig. 2.

In the first place, a reliable, double-pole switch should be fitted in the a.c. circuit supplying the unit. As the rectifier should not be left switched on when not in use, an Osglim pilot lamp is connected across the supply line, between the switch and the input terminals, to act as a warning signal that the current is switched on. The connections to the rectifier units themselves are, perhaps, best made with stiff, single-core, insulated wiring in order to ensure that the wires keep clear of the rectifier parts.

The output wiring is connected to a socket to take a plug for supplying the motor, but if more than one motor is driven from the rectifier, either a two-way connector is used or a small, insulated distribution box is fitted. Plug connectors will usually be found more convenient, as the motor can then be readily removed for cleaning and oiling. When the double-pole switch in the supply line is opened, the rectifier with its output wiring becomes dead ; the motor can, therefore, be safely controlled with a simple, single-pole, on-off switch. The earthing connection for the motor can be taken to the earthing wire of the a.c. supply circuit by employing a 3-pin plug.

Working Conditions

When using a rectifier in this way, there is some voltage drop in the output circuit. However,

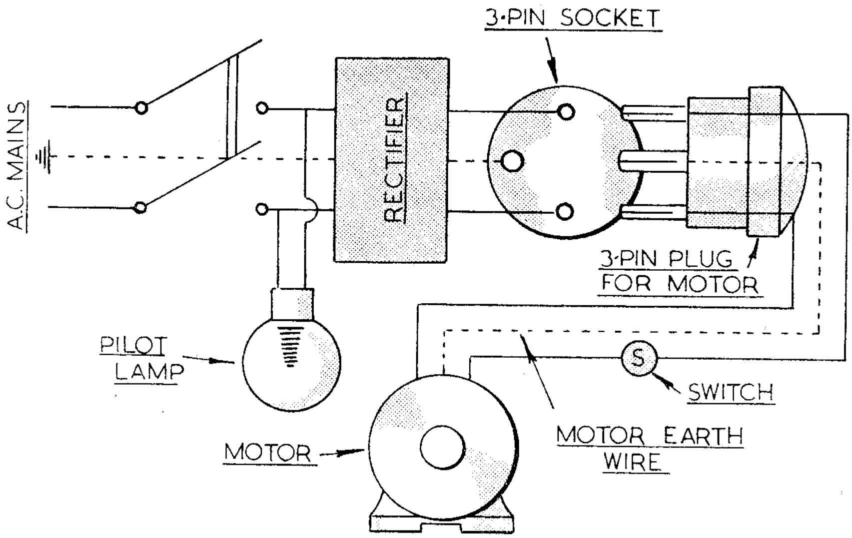


Fig. 2. Wiring diagram of the rectifier, and its fittings

if the a.c. mains are 240 V, and the d.c. motor is wound for 220 V, there will be no appreciable falling off of the rated power or speed under ordinary working conditions. For example, it was found that a motor used for driving a grinding wheel ran at 1,700 r.p.m. when connected to the 220 V, d.c. mains, but when supplied from the rectifier this motor, with the same loading, ran at 1,660 r.p.m.

Again, a ¼ h.p., 200/230 V, d.c. motor, driving a lathe, maintained its rated speed of 1,425 r.p.m. when supplied by the rectifier connected to the 240 V, a.c. mains.

The rectifier unit described has been in use for nearly five years, and its main purpose is to supply the ¼ h.p. motor driving a 3½ in. lathe; nevertheless, at no time has any trouble been experienced nor has there been any falling off of power; there is, therefore, no good reason for altering the present satisfactory arrangement.

A Half-seconds Electric Clock

(*Continued from page* 808)

form a stiffener, to strengthen and assist while building up the case.

This stiffener was fixed in place with "Croid" glue and panel pins, and the top half-rings fixed carefully in place, using the same materials.

To fill in the rest of the top, three pieces of wood were glued and pinned as shown.

After the glue was dry, the surplus wood was carefully planed off and the three wood inserts finished to conform with the curve of the rings.

The plinth was then fixed with glue and panel pins inserted from the inside.

It should be mentioned that the stiffener was fixed at the rear edge of the glass groove, and that the front piece of plinth was taken only to the front edge of the groove, to enable the glass to be slid up the groove from underneath.

The case sides rest on the baseboard of clock (see lower detail), and the back of the case was made a good fit to the backboard.

To prevent the case going too far back, large washers were screwed to the rear of the backboard, and overhanging the edge (these can be seen in the photographs).

The panel pins were driven in, and the holes stopped with plastic wood, after which the case was stained and wax polished.

The plates and wheels were polished, and finished off by being spotted by means of coarse grinding paste, and a small leather pad rotated in the drilling machine, after which they were given a thin coat of clear cellulose.

The main frame was enamelled with a pleasing grey, also the pendulum bob, and the magnet frame.

The clock has gone very satisfactorily since completion and is quite pleasing in appearance.

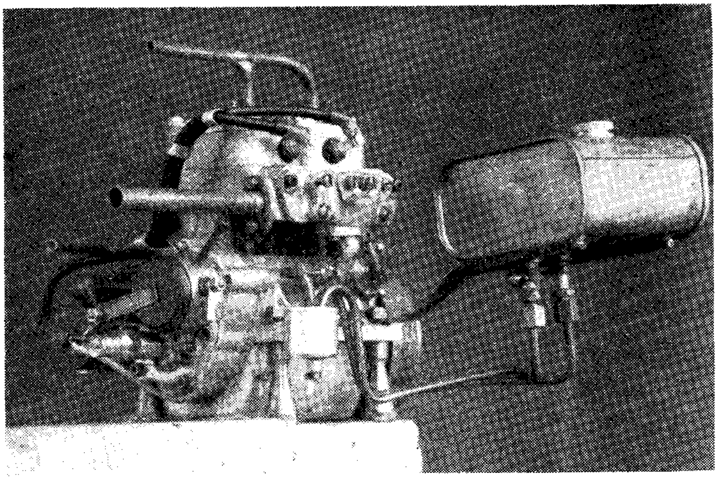
In conclusion, I shall be glad to give any additional information I can *via* the Editor of THE MODEL ENGINEER.

PRACTICAL LETTERS

An Assam Reader's "Seagull"

DEAR SIR,—Not having seen in THE MODEL ENGINEER a report of a "Seagull" engine completed by a reader, I am prompted to write to you regarding mine.

The castings were purchased during my home leave in 1950, as was the M.L.7 lathe, on which machining of the castings was started in January last year. It is not strictly complete, as may be seen in the photographs a few hex. nuts and studs remaining to be made for replacement of the assorted slotted and Allen screws.



A "Seagull" 10-c.c. twin petrol engine made in Assam

After several hours' running-in, in the lathe, the engine started readily with the application of ¼-in. electric drill gun, with a ball and crosspin engaging with the flywheel starting dog. Tick-over is most satisfactory, and to hear the throttle response, either way, is pure joy.

During the course of construction, I made quite a number of deviations, making up tools and lathe equipment. My lathe tools were, until recently, kept sharp by hand stoning, all of which accounts for the length of time taken to date.

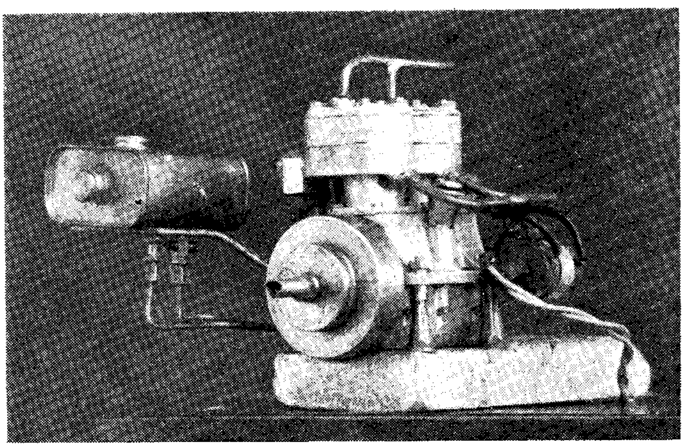
Materials used might be of interest, as considerable mileage was covered in search of them.

A high-grade cast-iron bushing stock (U.S. Army surplus) was used for pistons, cylinder liners and flywheel; a valve spindle from a Marshall's "K" class engine, for crank and camshafts; motor-car wheel spokes for studs, etc. I was much exercised about the valve-springs and could find no suitable spring wire, and eventually tortured a thick string from a guitar into shape. Lister diesel valves were put to the appropriate use.

No suitable bar material could be found, for the camshaft jig, so this was hacksawed and milled from solid; otherwise the most excellent instructions were complied with, and no setbacks occurred until the final stages, when by miscounting turns of the leadscrew, one of the cylinder water flange bolt holes was drilled completely through the liner; but as I was not really satisfied with the lapping of that particular liner, perhaps it was a good thing.

I can't say that I am completely satisfied with my efforts, and the first improvement will be the reduction of the connecting-rod weights.

The engine is to be installed in a 4 ft. cabin cruiser, now under construction, and radio control is planned. Patterns have been made for the gearbox casting; the gearbox, it is hoped, will perform the combined functions of reversing, reduction, and twin-screw contra-rotating drive. I can only wish I had Mr. Westbury's instructions for this gearbox, not because I can only work to instructions, but just to be sure that, all things being equal, it would be successful and perform the required functions.



Reverse view of the "Seagull" engine

The whole job has been planned for some time,

but became a very definite idea when I happened to see a Nepoli sawyer felling a "Poma" tree. A friend had built two very successful model yachts from this wood, so an arrangement was made whereby two large planks were stored for seasoning, against my return from leave. When the "Seagull" engine series appeared in your columns I realised it was a necessity, but being a first attempt, my timber was left untouched until the day that the engine became a certain success. Marine architects may grit their teeth, but the design for the cabin cruiser started with three views of the engine, complete with proposed gearbox, and all water and exhaust plumbing; the hull was drawn, around and about, to suit.

I would like to thank Mr. Westbury for the design, the instructions and the incentive. He might comment adversely on the bird-feed fuel system, quite rightly; it is not satisfactory. I realise why now, and in the full installation the air bleed will be kept above "float'" chamber.

Yours faithfully,

Tiphook, Assam. R. C. CORPS.

Electronic Organs

DEAR SIR,—In reply to Mr. Wemyss's "Practical Letter" in the May 1st issue, I am using a tone wheel system on the "Hammond" principle using $1\frac{1}{2}$ in. dia. tone wheels of 2, 4, 8, 16, 32, 64, 128 high points feeding two five-octave manuals and twenty pedals with the fundamental note and up to eight harmonics if required.

This instrument is the result of years of research and experiment by my brother, Mr. C. C. Clarke, of Welwyn, who has also produced a very successful instrument.

I find there is no more difficulty in building this tone wheel system than in a normal "Live Steamer," and the results are equally as fascinating.

Precision work is essential, and much somewhat boring repetition work is involved; but that should not be beyond the ability of any model engineer with an average workshop, the only qualification being that access to a fly-press is necessary to build the comprehensive instrument my brother and I contemplated.

The simple and well designed one-manual instrument recently described in *Mechanics*, March to May, 1951, should prove a very fascinating instrument to any enthusiast desiring to make a start, and could well prove a nucleus for ambitious additions later.

My mail proves the growing interest in this branch of electronics, and I have no hesitation in saying that it will prove very popular in a very short while; its possibilities are so limitless.

Yours faithfully,

Chelmsford. J. J. CLARKE.

DEAR SIR,—The comments of Mr. Hutton on my idea for converting a harmonium suggest that he has not had much practical experience of reed generators. Although I have not built a complete organ, I have succeeded in producing single notes from harmonium reeds using both electro-magnetic and electrostatic pick-ups, and I am convinced that this method has great possibilities for amateur construction. It is true that harmoniums have brass reeds, but this does not mean they are a "total loss for magnetic methods." All that is necessary is to attach a small piece of thin sheet iron to the reed, a simple idea that would have occurred at once to any true model engineer. As to the "high polarising voltage" required when using the reeds as electrostatic generators, it need be no higher than that used in many amplifiers, 350-400 V is adequate. Of course, a certain amount of care is needed in insulating the reeds or the result may well be some extremely hot music. Incidentally, T.V. sets employ much higher voltages than this, yet I believe certain intrepid constructors have built these and lived.

The idea of just putting a microphone in the works fills me with horror, the result would presumably sound just like a harmonium, only louder. This is not the case if pick-ups are used, because a reed does not vibrate evenly over its whole length (as I did on reading Mr. Hutton's letter). Instead, various harmonics are emitted from different parts of the reed, and by using several pick-ups and selecting the outputs, a remarkably varied series of tones may be obtained. It is thus possible to build an organ with several stops but only one set of reeds.

In conclusion, I note that an electronic organ was shown in a recent "M.E." exhibition. If the constructor of this instrument is still of sound mind after his effort, could he be persuaded to come across with a little information?

Yours faithfully,

S.W.9. MICHAEL OXLEY.

Twist Drill Grinding

DEAR SIR,—A lot of space has been devoted in our journal of late to the construction of a jig for grinding twist drills. On this subject, I have an axe of my own to grind, and I don't need a jig, thank you! My personal opinion is that any model engineer thinking of spending a lot of hours making a jig to carry out this simple operation would be well advised to try his hand at the old-fashioned manual way of doing it *first*.

If he were to buy a good quality drill of about $\frac{3}{8}$ in.-$\frac{1}{2}$ in. diameter, study the way it is ground, and then settle down to his grindstone with a few old drills and try to get the same angles as his new drill, he would soon become proficient in this useful art. Even if it takes a couple of hours, it is still considerably less than the time taken to construct a jig, which is after all very limited in its application. I have yet to see the jig that will successfully sharpen drills from 60 to 80.

Just suppose you were in a friend's workshop and he asked you to touch up a drill for him, wouldn't you feel a mug if you had to say: "I am sorry, but I can't do it, I haven't my jig with me?"

Learn to do this job properly by hand, and you will gain a lot of satisfaction, and what is more important you will add to your store of personal craftmanship.

Yours faithfully,

Petts Wood. G. LINES.